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ENGINEERING AND MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

Photographic Surveying for Mining Engineers

By Lawrence A. Woodworth

Marketing of Antimony

By Harris K. Masters

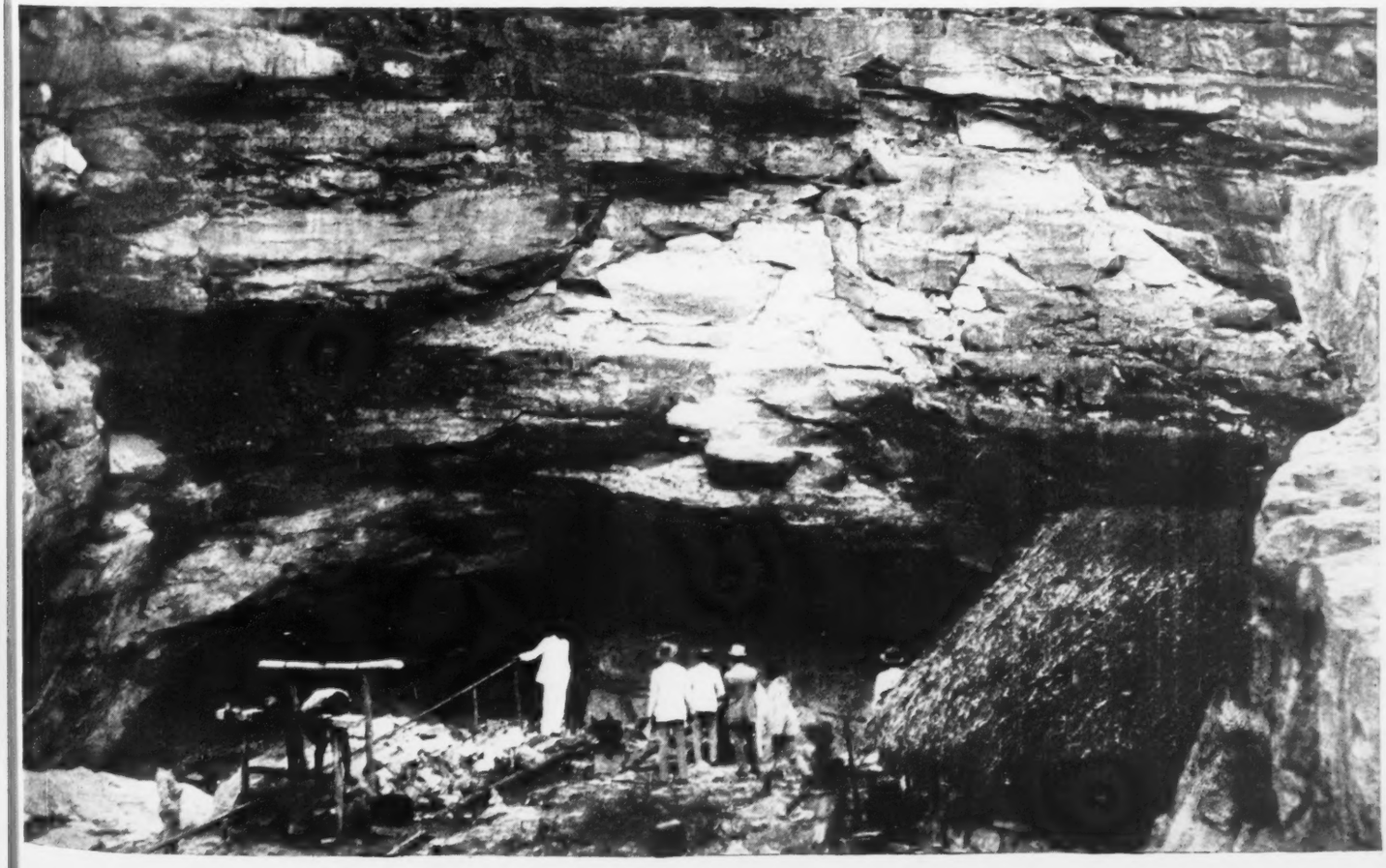
Biography of Erskine Ramsay

One of the builders of the Birmingham district

Drill Diamonds—Carbons or Carbonados—Their Occurrence in Brazil

By F. Lynwood Garrison

IN THE so-called Chapada Diamantina, in the State of Bahia, is the only known source of the carbons used in drilling. These are found for the most part in stream beds and old stream deposits whose detritus has come from the erosion of the Lavras series of rocks. In some sections drouth prevails and soft spots or pockets occur in the rocks, from which the disintegrated and weathered material is gouged by natives, carried to the nearest water, and washed. At times great quantities of rock are thus removed and cavities such as that shown below have been formed. Because of the primitive methods used the author believes that there are large reserves of stones in the stream beds, bars and swamps of the region, presenting an opportunity for profit to an enterprise that is adequately financed and well organized and directed.



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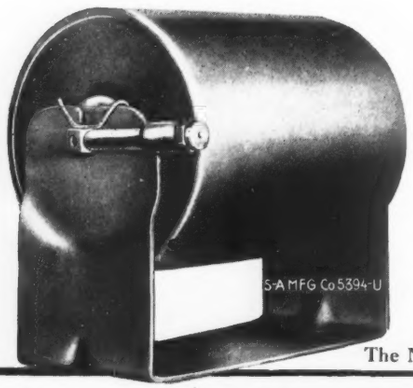

The New Unit

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ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

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Taxation and Poverty

TWO BULLETINS on apparently unrelated subjects lie on our desk, each highly interesting and significant. One is a bulletin of the National Industrial Conference Board on taxation. The figures show that the total amount of taxation is on the increase. The total taxation by all government authorities in the United States has risen from 1,080 million dollars in 1890 to 5,010 millions in 1923. The "burden of taxation on industry" is three and one-half times as high as before the war (1913), measured in terms of dollars; measured in terms of purchasing power, it is two and one-half times as high.

From 1890 to 1913 the relation of total taxes to the national income is represented by a decreasing percentage (7.2 to 6.4); but the war brought the ratio in 1921 to 16.7 per cent, which by 1923 had declined to 11.6 per cent. "Thus," says the report, "about one-eighth of the national income goes toward the support of government authorities in this country, as compared with one-sixteenth before the war." This statement is, however, an example of the loose statement which can creep into the report of a sober statistical bureau. The money raised by taxation does not all go to "the support of governmental authorities," as we all know. The money spent in highway construction, for battleships, and for a thousand other purposes is a solid investment in real property, which belongs to the people and enriches them.

The other and quite unrelated bulletin is from the U. S. Department of Commerce, on "Paupers in Alms Houses, 1923." We note that there were 66,000 paupers in the alms houses of the United States in 1880, and 78,000 in 1923. This figures 132 paupers per unit of 100,000 population in 1880, as against only 71 for a similar unit in 1923. The ancient sentimental ballad, "Over the Hills to the Poorhouse," is losing its sob value. Well-to-do and healthy individuals who are haunted by a fear of the poorhouse in their old days will do well to select some other phobia. Statistically, their chances of getting into the poorhouse are only about three times that of their getting into Who's Who; and their chances for the latter are increasing much faster than those for the former. The ratio in either case is so small as to leave little ground for rational worry. Moreover, if you are a female, your chances for the poorhouse are far less. In 1880 male paupers were in the ratio of 116, to 100 females; in 1923, however, there were 223 (and seven-tenths) males to 100 female paupers! It is an increasing privilege to be a perfect lady; and these figures should more than offset the prejudice, originating in China, against a large family of girls.

Taking these two bulletins together, it appears that while we are being taxed more and more heavily, we have less and less chance of being taxed into the absolute poverty for which a part of the taxes we pay provides an ultimate relief in the poor farm. Things cannot be so bad, in spite of our income tax. The present scheme in taxation is undoubtedly to "soak the rich"; or, rather, to tap everybody that has a surplus dollar. Naturally, the prosperous squirm, and "industry" mourns; but in the end it is a great and wonderful change over the old days when the poor were "soaked" for the benefit of the rich. From the tax gatherers' standpoint there is the added practical advantage that the rich have it, while the poor do not; the process of commanding to "stand and deliver" is therefore a more restful one, and much more productive of results. Most of us, therefore, will go on grumbling at the high taxes without losing the knowledge that things move onward for the better. The high tax payer, to be sure, illustrates the condition of "taxation without representation," and also controverts the constitutional declaration that all men are free and equal; but we would do well to be progressive in thought and not hang to old saws too tightly. The old maxim of *noblesse oblige* is a flat contradiction of equality.

An Unworkable Suggestion for the A.S.P.A.

ONE OF THE FIRST TASKS confronting the recently formed American Silver Producers' Association is a sifting of the numerous suggestions the association has received, and is receiving, giving counsel about the most profitable field for its activities. In separating the wheat from the chaff it might be well to discard at once the prominent suggestion of another publication that the spread between the New York and London silver markets may be reduced and that a saving of one to two cents per ounce could be brought about by "intelligent" effort. In the first place, this suggestion cannot be founded upon fact, for the spread between the New York and London silver markets is not nearly so large as indicated, and moves within narrow limits. The normal spread is the cost of transporting silver from New York to London, which is today about 1 per cent of the value of each shipment. Lately the New York quotation has been relatively higher than London, because of the orders which have been placed in this market by Far Eastern interests, thereby avoiding any contact with London.

To make the matter thoroughly clear, let us analyze the two markets for some recent date—say, Sept. 15—when New York bar silver was quoted at 69⅜c. per troy ounce, 999 fine, and London at 34 13/16d. per troy ounce, 925 fine, with sterling exchange $4.455. If we reduce the London quotation to dollars and cents in silver 999 fine, we find it to be 69.85c., or 0.47c. higher than the New York price. Hence the spread is lower than the normal differential of 1 per cent, or 0.7c. In other words, the New York market on that day was relatively higher than London.

It is ridiculous to expect a saving of one or two cents by working upon the spread between the London and New York silver markets. The relative value of silver

in any of the world silver markets is automatically, quickly, and wonderfully taken care of by so-called arbitrage transactions; that is, sales of silver from a lower to a higher market purely for the purpose of making a profit from any abnormal spread between the two. Arbitrage transactions are common in all commodities and prevent the various major and minor markets in different parts of the world from getting violently out of step with each other. The most important silver markets, New York, San Francisco, London, Bombay, and Hongkong, all move together, up or down, with slight irregularities, which are quickly corrected by arbitrage sales when they become too severe. If anyone doesn't believe this let him make a few transactions in the international silver market when he thinks the spread is too high. The experiment may be costly, but it will be worth the price.

Arbitrage is particularly common in the silver market, for the price of silver is definitely linked with the Far Eastern exchange market, so that transactions in silver may involve transactions in Oriental currencies, and vice versa. The natural economic machinery which determines the price of silver throughout the world is extremely delicate, and any tampering with it on the part of American silver producers is likely to act as a boomerang ultimately.

A Southern Exposition

WHAT MORE FOOLISH IDEA could be expressed than that the North did not wish to see the resources of the South developed, an opinion that a passenger from Muscle Shoals recently gave vent to on a Pullman as it drew out of Sheffield, Ala.—as if capital were provincial and had not already entered Southern industry from the North in important sums! Show capital, be it North, East, South, or West, an attractive opportunity for profit, and it will not be slow to take advantage of it wherever it may be.

The South has great resources — agricultural and mineral —and abundant water power, and no longer is it dependent so completely on King Cotton, as formerly. Where once almost the entire cotton crop was transported elsewhere for conversion into cloth, today the textile mill is steadily becoming a more and more common sight in Southern towns. Today the South desires buyers for its products, to attract visitors, gain new citizens, investors, manufacturers, farmers, professional and business men. And so it is that, through the efforts of Southern chambers of commerce and other organizations, and business men, a Southern Exposition will be held next January in New York in the Grand Central Palace—the setting of many another display for similar purposes in the past. The exhibits will include the products of factories, industries, mines, and agriculture, and in general will show the progress of development. The undertaking is a co-operative movement and is said not to be a profit-making venture. Among the officers one notes the name of Colonel Joseph Hyde Pratt, of Asheville, N. C., a geologist and mining engineer, who is vice-president of the Exposition.

Those members of the A.I.M.E. who elect to visit Mascot, Ducktown, Birmingham, Muscle Shoals, and other points en route on the occasion of the fall "meeting" beginning Oct. 7 will have an excellent opportunity to see something for themselves of the mineral, power and other resources of the South.

Too Much System

TO PHRASE an old thought in an old way, it is possible to get too much of a good thing. We hear much less of the efficiency engineer than we did a few years ago. We have nothing against him. There is plenty of room still for organizing industry and scheduling operations so as to get the biggest results with the least work. But the idea that a standardized set of methods could be devised and applied with changes in detail only to any factory or shop or plant or mine has been exploded. The biggest trouble was that in his enthusiasm the efficiency man overdid things.

As an example, consider the plant of a well known manufacturer of mining machinery. An effort was made to apply a highly developed system of control in certain departments of the plant. The men who made the attempt had used their system, successfully it may be presumed, in an automobile plant where every chassis was exactly like every other chassis and "mass" production was the problem. But in the manufacture of ball mills, there were small differences in design. One specified a right-hand drive, another a left; this customer called for one type of liner or feeder, that for a different one. It was found after thorough trial that the work required to provide for the necessary readjustments in the "system" was greater than the benefits derived. A much simpler method of control was devised and is in operation.

In a western mine a bonus system of paying underground workers was based on recording in detail the accomplishment of each man each day. Every standard performance counted a definite credit. It developed, however, that the miners became adept at running up their credit score by a dozen little dodges, some technically honest, others dishonest; but that did not get any more rock broken nor moved into the chute. Timbering was not done with the necessary care. Moreover much time was lost making the records, and the calculations in the office were a source of expense. Underground operations are peculiar. Conditions vary greatly in different places in the same mine. Methods that are reasonably satisfactory in surface plants may be entirely impractical when an effort is made to apply them underground.

The getting of a fair day's work from a miner will always be a more difficult problem than getting it from a ditch digger or a lathe runner. A good principle to bear in mind, however, is that there may be such a thing as "too much system."

The About Face

THE CASES are very numerous these days when mining engineers, after having made a success in their chosen vocation, are considering beginning apprenticeship in a new business. Having lived in isolated communities for a decade or two, the instinct is to find some station in which one may view the advancing years with more of a feeling of fixity; where one may allow one's roots to penetrate the soil in all directions. Or the engineer finds the opportunities fewer, the conditions more severe, the reward not greater than for less adventurous occupations; and in a lull of mining activity, casting around for an anchor, he finds moorings in some other occupation, and there remains. Whether these about-faces of occupation are more com-

mon with the mining engineer now than formerly is open to debate; it would so seem.

Considering the field casually, it seems unusual that a mining engineer changes to some other form of engineering. Civil engineers often turn mining engineers, but mining engineers rarely take up civil engineering, or, indeed, any form of engineering, when they forsake mining. The reason is that the mining engineer is not so much an engineer as he is a miner—mining is an industry rather than a form of engineering. Therefore, the truth is that the retired mining engineer feels little aptitude for civil or other engineering.

One of the avenues of retirement is to professorships in colleges where mining is to be taught. Some go into the various bureaus of the Federal Government where mining engineers are in demand—the Interior Department, Department of Commere, the Treasury Department. Business—especially that allied to banking—attracts many. Mining is largely business, being an industry; mining engineers who have advanced in the profession have been well trained along business lines and as executives. Bond houses, trust companies, even real-estate organizations, receive may. The dream of the miner, as of the sailor, naturally turns toward a ranch, a farm, or an orchard; hence one will find them cultivating apples, or hopefully raising chickens or hogs in some rural and beautiful retreat.

It is not every young man who has the grit to educate himself for a profession—say mining engineering—in his youth. Those who do not have the will power and the intelligence to do this form the great majority of citizens. And those who ten or twenty or thirty years later have the courage to learn a new art or a new trade are very few indeed. Yet Cato, as is often quoted, learned Greek at eighty. Joseph Conrad began to write novels after he had retired as a sea captain; and the examples of such achievements might easily be swelled. It is not the ordinary thing to do, and for that reason alone not often done or dreamed of; but there is no reason why it should not be done, if advisable.

The man trained in one profession, if he has been successful in that, is surely capable of mastering another business if he wills to do it, far more readily than he learned his first profession. There is no stiffening of the brain to fear; our statesmen, our leading business and professional men, are mainly quite mature. It is the man who has failed in one avenue of life that may well face the entrance to a new avenue with trepidation. Yet such is the psychology of man that the failure turns toward an untried occupation with confidence; and the successful man views a change with overmodesty and weak knees.

Most mining engineers have a need in this direction, more or less acknowledged; a need for a stable business, when one no longer climbs ladders joyfully or is willing to take the train for Oaxaca on short notice. A side issue, an avocation, a second line of defence, would be a good plan for even young engineers—a hobby on which they could study as a relaxation, and on which they might fall back seriously if and when the time comes.

Most engineers laudably look forward to retiring on a large or small fortune; but Fortune is uncertain, and even men whose bread and butter and club and automobile are assured are not happy if they are not earnestly and usefully employed—not if they have spent years in the strenuous occupation of mining.

"Easy Money"

ONE OF THE CHEAPEST THINGS to "buy" today is money. The Federal Reserve rediscount rate—3 per cent—is the lowest of any central bank in the world. In the general money market, time funds are to be had on good collateral as low as 2½ per cent. Call money can be procured for 2 per cent.

The unusually low cost of borrowing money is merely the consequence of having an immense stock of gold and credit available. Much more credit is available than the average business man needs for the conduct of his affairs, notwithstanding the fact that the total volume of credit in use is at a record high. Contrast this with the credit position of Germany, where short-term loans bring a rate of 24 per cent, and with business houses glad to get capital at almost any rate. One would think that American funds would be attracted by the high rate abroad, but they evidently prefer the security of lending to borrowers in the United States over the uncertainty of developments in Germany.

One effect of these low interest rates in the United States has been to cut heavily into the earning power of the loanable funds of the banks. Whereas these institutions obtained 6 to 7 per cent and more not so many months ago, they must be content with 3 to 4 per cent today, which is a cut of 40 to 50 per cent. Some central banks are reported to be worrying about meeting expenses. Even long-term investments have been affected by easier money conditions.

Industrial, governmental, and mortgage bond issues are being floated at rates that are much lower than those prevailing a few years ago. In 1920, the reader will recall, the Copper Export Association financed a stock of surplus copper through a bond issue carrying 8 per cent interest. This same financing today could be done at much lower terms. Many persons well qualified to speak in 1920 predicted that interest rates would remain for years on a permanently higher basis. Some enterprises that proceeded with their long-term financing on this assumption have had reason since to regret the step. Recently the financial difficulties of a large Chicago packing house were attributed to this incorrect interpretation of the future course of money, the company having floated a huge bond issue at a high rate and being burdened recently with excessive fixed charges therefrom. This only goes to show how precarious it is to forecast the course of prices of any commodity or service.

One hears commonly today the expression that the public has been "educated to high prices" and that we shall never return to a lower level. Perhaps not. But we would hate to think that the present general price level has become immovable merely because it has been relatively stationary for many months.

Easy money is helpful to all industries, and makes the cost of carrying on operations cheaper. The mining industries will be no exception and will benefit by this condition in both short- and long-term financing. Easy money will also act as an inducement for capitalists to launch new enterpises. They will be attracted by those industries offering a high return on investments and in which competition is not too keen. In fact, this is one of the natural economic means of leveling prices and bringing any unbalanced relationship into line. It will doubtless have far-reaching effects on every business activity.

A Builder of the Birmingham District

Erskine Ramsay

By George Huntington Clark

PROMINENT among those who may justly be called the builders of the Birmingham district, in Alabama, is Erskine Ramsay, mining engineer, inventor, coal operator, author, and philanthropist. It is principally in the coal and coke industries that Mr. Ramsay has achieved his reputation as an engineer, but so closely are these industries interwoven with that of ore mining at Birmingham that one can scarcely be discussed without reference to the others. Newer and improved systems of mine development in respect to the layout of mine workings, the drawing of pillars, the split system of ventilation, the introduction of shaking screens, and improved washers of his own devising, the installation of boiler plants at coke ovens for generating steam from waste heat, the introduction of inside boilers for furnishing steam to pumps and engines, the Ramsay mine-run coal sampler, and the revolving car dump are among the many improvements of his own invention brought to bear on Alabama mining methods. More than forty patents, now in general use, on various devices and machines employed in coal mining, blast furnaces, coke ovens, and elsewhere, embody the concrete results of his professional work along specialized lines. In achieving distinction in mining Mr. Ramsay has but followed in his forebears' footsteps. Robert Ramsay and William Erskine, his grandfathers, and William Ramsay, two generations earlier, were coal operators in Scotland, and his father, who came to Pennsylvania in 1863, within the quarter century following rose to be consulting engineer for the H. C. Frick Coke Co. and superintendent of its Standard Mines. Taking advantage of his opportunities as they occurred, the younger Ramsay obtained experience in the shops of the Shafton, Carnegie, and Frick companies and became familiar with the machinery used in the coal and coke industry and gained a knowledge of the administrative and sales department of the business—this without interfering with his schooling. Thus it was that, upon his graduation from St. Vincent College, at eighteen years of age, he was able to assume responsibility as superintendent of the Frick company's Monastery mines and coke works. Here his success in establishing new cost and output records attracted Mr. Frick's attention, and in 1885 and 1886 he took charge of the Morewood Coke Co. and the South West Coal & Coke Co., which were among the largest operations in the coke region.

ERSKINE RAMSAY

A year later, at the age of twenty-two, he was made assistant engineer for the Frick company. In all these posts he had the distinction of being the youngest superintendent in the coke region. In 1887, T. T. Hillman, vice-president of the Tennessee Coal, Iron & Railroad Co., induced Ramsay to come to Alabama for the purpose of considering an appointment as superintendent and engineer of the Pratt Mines division. A week spent in looking over these mines gave him a vision of the future of iron and steel making in the Birmingham district, and he accepted Hillman's offer. From then on he was a factor in the development of the district. During the fifteen years of his continuous service with the Tennessee company, the latter half of that period as chief engineer and assistant general manager of the company's large and varied interests, he brought about many radical and permanent changes in its various mines and plants. Upon severing his connection with the company he became vice-president and chief engineer of the then newly organized Pratt Consolidated Coal Co., a position that he still holds. He is also an executive of several other important companies. In 1911 Ramsay was a member of the commission sent to Europe by the Bureau of Mines to study mining conditions there. During the War he served on the Committee on Coal Production. At present he is vice-president of the National Coal Association. He has nevertheless found time to write many technical papers and has taken an active part in the development of the banking, commercial, real estate, and manufacturing interests of Birmingham. He has contributed freely of his time and means to the solution of the educational problems of the state and district. His recent gift of $100,000 to the Alabama Polytechnic Institute for an engineering building, together with other gifts for educational purposes, are typical of his constructive character.

Photographic Surveying for Mining Engineers

A Method Especially Applicable for Topographic Mapping

By Lawrence A. Woodworth
Mining Engineer, Berkeley, California

PRACTICALLY ALL ENGINEERS have cameras and take pictures for their own amusement. Many have become proficient, not only in the art of taking pictures but also in dark-room technique and in the use of the enlarging camera. Some use this knowledge of photography to obtain illustrations for papers, reports, or other special purposes, but beyond this few engineers have any particular use for their cameras. Perhaps it has never occurred to them that their cameras, properly used, are very valuable surveying instruments.

Nearly all the literature upon the subject of photographic mapping describes the methods used in governmental surveys of large areas, and consequently is of little application to the average engineer who maps comparatively small areas at larger scales. Therefore, a few notes from my own experience may be of value to other engineers.

Principles Date Back Many Years

The idea of using photography for mapping purposes is by no means a new one. Photographic mapping was first introduced in 1839. Since that time the French and German armies have used it to great advantage. In 1886, E. Deville, Surveyor General of Canada, mapped many square miles in the mountainous parts of Canada by this method. In 1898 the U. S. Coast and Geodetic Survey mapped 12,000 square miles, and in 1904 the U. S. Geological Survey used the panorama camera in Alaska. Yet today comparatively few engineers know anything of photographic surveying.

The principles underlying the use of the camera for surveying are few and simple, but to be successful a certain amount of skill and care is necessary, particularly when extemporized instruments are used. One of the most difficult tasks is the taking of suitable pictures. The variation in the light and the color of the objects to be photographed cause the novice and even the experienced photographer some difficulty, and often smoke from factories and fires hinders the work. The objects most desired in surveying photographs are usually at great distances from the camera, and to secure these features proper ray filters must be used. The pictures must be of proper density and contain sufficient detail to admit of reasonable enlargement. To make sure that sufficient pictures have been taken to cover the entire territory to be mapped, and to secure the proper quality of pictures, the negatives should be developed before leaving the field. For this purpose a small portable developing outfit is always taken to camp.

Films Have Decided Advantages

Films are much handier than plates, as they are less likely to be broken and can be readily developed at night in camp without the use of elaborate equipment. With films, however, there is the possibility of shrinkage, but in my experience this item has been negligible. Experience alone can teach the surveyor what views to take and what views are unnecessary. It is better to take more views than are necessary than not enough.

After one has become proficient in the use of the camera for mapping, there are many occasions where it can be used to save time and money, some of which are: The measurement of yardage in surface excavation; the progress in excavations and on construction; the reconnaissance for location of roads; the examination of reservoir sites and bridge sites, and the taking of topography for geological study.

Theoretically, all kinds of mapping at all scales can be accomplished by means of the camera. Practically, however, there are certain limitations in the use of the camera for surveying. Experience has shown that plotting to scales larger than 200 ft. to the inch is not very practicable, owing to the size of the sheet necessary to contain all of the stations. Furthermore, to secure the necessary detail for these large-scale maps, pictures have to be taken very close to the object to be plotted and cover very little of the country, and consequently the number of pictures necessary is greatly increased and the labor involved in plotting the data is such that other methods are more practical. On the other hand, where the scale is small, large areas can be mapped by the camera much more efficiently than by any other method. The method fails in flat country, as it is impossible to get sufficient detail in the pictures. Forested areas present more or less difficulty, but usually these regions can be mapped if too much detail is not required. The method lends itself to the mapping of rolling or mountainous land and can be used to great advantage in the mapping of inaccessible hills and ridges.

Film Pack Preferred

In the work which I have done, a Premo camera No. 12 with a kodak anastigmat lens and an optimo shutter was used. This camera was selected because it gave the largest picture for the size of the camera. It used a film pack or plates. The film pack possesses advantage for rapid work, as individual films may be removed and developed before the remainder of the pack has been exposed. The only change necessary in the camera was the gluing of four indicators of dull black paper on the inside of the film-pack holder to mark the principal plane and horizon line upon each negative.

Before discussing the subject further it may be well to define the terms used in connection with photographic surveying. The *picture plane* is the plane of the picture and, in all of this work, is a vertical plane normal to the axis of the lens. It is always a distance, known as the focal length, in front of the station, and should not be confused with the negative plane, which is a parallel plane at the same distance to the rear of the station. The *horizon plane* is a horizontal plane containing the optical axis of the lens and cutting the picture plane at right angles. The intersection of the horizon plane with the picture plane is the *horizon line* and by definition is horizontal. The *principal plane* is a plane containing the optical axis of the camera and is at right angles to both the picture plane and the horizon plane. The intersection of this plane with the picture plane

gives a vertical line known as the *principal line.* The *horizon line* corresponds to the horizontal cross hair and the *principal line* corresponds to the vertical cross hair in a transit.

The intersection of the picture plane with the plane of the map or ground plane is called the *picture trace.* In Fig. 1 the actual station is letter *S* and the vertical projection of this station is *S'*. *A* is the actual location of a point in space. *A'* is the vertical projection of the

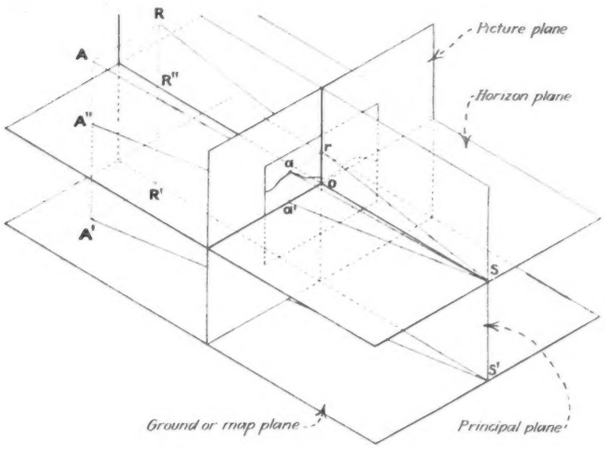


Fig. 1—Diagram showing the principles of the method

point upon the map. The line joining *A* to *S* is known as the visual ray, and the point in the picture plane where the visual ray intersects it is the perspective of *A*. The distance from *A* to *A'* is the actual elevation of the point *A* and the distance from *A* to the horizon plane is the difference in elevation between *S* and *A*. A vertical plane containing the visual ray will necessarily go through the points *A, S, S', A'*. The vertical projection of the visual ray is *S' A'*, and it forms with the trace of the principal plane the true horizontal angle. *S' A'* is called the direction ray. *S R* is the projection of the visual ray *S A* upon the principal plane and is used in obtaining the elevation of *A*. The perpendicular distance from *R* to the ground plane is the elevation of *A*. *S R* is called the elevation ray.

It is evident, then, that once having the picture trace and station projected upon the map, a direction ray may be drawn for any point in the picture by simply laying off upon this trace the distance measured parallel to the horizon line from the principal line to the perspective of the point and connecting this point on the trace with the plotted station. Therefore, if two pictures be taken from different stations containing the perspectives of the same point, the intersection of two direction rays similarly drawn will locate the point on the map. After locating the point on the map, the elevation can either be calculated or found graphically, as explained later.

Some Special Equipment Necessary

Figure 2 shows the field equipment used in surveying with a camera. It consists of a camera, an automatic spacer, a ray filter, circular level, tripod, sun shade, and a small piece of black felt to cover the forward part of the automatic spacer.

The camera, as has been stated, is a Premo No. 12, and as it is fully described in the manufacturer's catalog nothing further in the way of description is necessary here. Almost any other camera could have been used instead of this one, provided proper pictures could be obtained and needed changes in design of the automatic spacer were made to accommodate its size and shape.

The automatic spacer consists of a plate which is made level by means of four leveling screws and which can be made to revolve in a horizontal plane. Upon the plate rests the camera and circular level. To prevent glare from the plate a small piece of dark felt is placed over the front edge. Around the periphery are ten holes spaced 36 deg. apart. A stopping pall engages in these holes, insuring that the pictures be taken at certain definite angles to each other and have a proper overlap. The spindle must be normal to the plate and must be ground with the accuracy of a transit spindle. The automatic spacer shown in the picture is so designed that the optical center of the lens system is directly over the axis of the spindle.

The circular level used to level the camera with is of a very accurate type that is used to make the spindle of precise levels perpendicular. The ray filter which has proved the best is a Wratten K3. The sun shade consists of a piece of gray cardboard so cut that it will shield the sun from the lens of the camera. The tripod is of a rigid type commonly used with explorers' transits.

The Determination of Camera Constants

Before pictures may be used for plotting, two constants must be determined—namely, the optical center of the picture which is the intersection of the horizon plane and the principal plane with the picture plane, and the focal length of the camera, sometimes called the mapping constant. Instead of marking the traces of these two planes upon the negative by cross hairs,

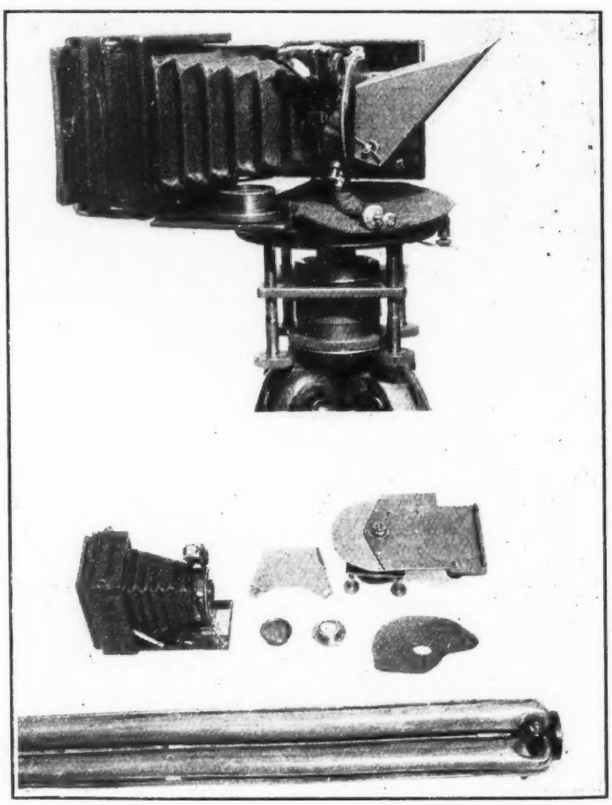


Fig. 2—The instruments required in the field

which would blot out some of the detail in the picture, indicators are used in the edges of the picture. By connecting these indicators, the optical center of the picture and the traces of the two planes are determined.

In cameras using plates or film packs it is necessary to insert in the back of the camera indicators which will give these marks upon each film. In the camera which I used these indicators consist of four pieces of dull black paper pasted in the film-pack holder. The position of these indicators does not have to be such that the lines joining them will give the desired traces and point, if the distance from them to the lines is determined. It is very convenient to place these indicators at the geometric center of the sides and later determine the corrections to be applied to them.

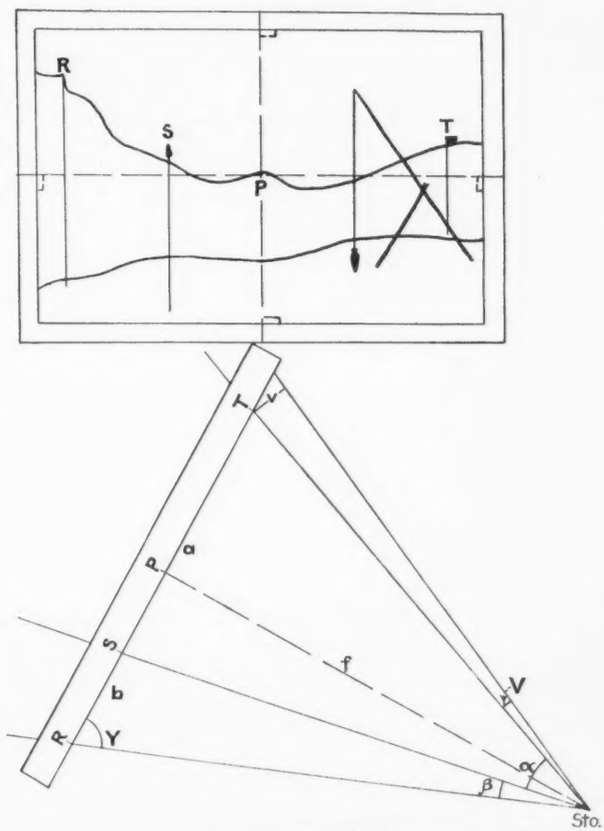
Great care must be exercised when using the film pack to place it in exactly the same position each time. To determine the true position for the indicators, the following procedure may be observed: The camera is leveled up over a hub; a heavy plumb bob is suspended with a heavy cord from 10 to 25 ft. in front of the camera in such a position that it will appear in the picture; a photograph is then taken and a transit is set over the same hub with the same height of instrument and horizontal and vertical angles read to at least three prominent distant objects which appear in the picture. After the picture has been developed and printed, lines are drawn with a needle point parallel to the plumb line through the prominent objects to which the angles were read with the transit. The distances between these lines are carefully measured and used to calculate the constants. The position of the optical center, horizon, and principal lines, and the focal length, may now be determined either mathematically or graphically. (See Fig. 3.) After these constants have been determined the camera is ready for surveying.

Field Procedure

When an area of over one square mile is to be mapped, a primary control should be made with a transit. The camera method is used for the purpose of filling in the detail and for the construction of the contours. The camera stations are selected so as to give the best views of the territory to be mapped, and these stations are located either by angles from triangulation stations or by angle and distance from a triangulation station or by angles taken from the station itself. Enough stations should be occupied entirely to cover the country to be mapped, with at least two views of the same territory from different stations. In practice, however, it it not always possible to secure two pictures of every point to be mapped, and consequently other methods involving the use of perspective geometry have to be used. It is here that the greatest skill of the draftsman is required.

For areas of a square mile or less the control may be made entirely with the camera itself. A base line of suitable length is chosen so that it lies between two prominent objects, such as large trees or bold, sharp, rocky outcrops. The camera is placed at one end of the line and a series of views taken in such a manner that one of the views contains a picture of the object at the opposite end of the base line. The camera is then taken to the other end of the base line and a similar procedure followed. From these two sets of pictures other stations can readily be established near other prominent objects in the landscape. When such objects are used as stations, it is rarely possible to occupy them with the camera, so offsets from them are taken and the camera is placed over these offsets, the distance and bearing to the actual station being measured and recorded in the field notes.

If no suitable natural signals occur at places where stations are necessary, signals must be built up either of rock or trees. The station procedure is as follows: The camera is placed upon the leveling head so that



Camera Constants

Graphic Method. Through R, S and T draw lines parallel to the plumb line. On a strip of paper mark off the distances between the lines. On the drawing board lay off the angles a and β which were measured with the transit. Adjust the strip until the projections of R, S, and T fall on their respective direction rays. Drop a perpendicular from the Sta. to the strip. This is the focal length and TP is the distance from T to the principal line. Measure this distance from T and draw the principal line II to the plumb line. On the drawing board plot the vertical angle for T and at the strip (which is on the picture trace) erect a perpendicular v to the direction ray for T. This is the distance from T to the horizon line. Lay off v on the picture and through this point draw the horizon line perpendicular to the plumb line, intersecting the principal line at P, the optical center. The indicators can now be properly located.

Mathematical Method. This method consists in solving for the angle Y by means of the following formula:

$$\cot Y = \frac{a + b \sin a}{a \sin (a + \beta) \sin \beta} - \cot \beta$$

Then by means of the sines the distances T P, f, T to the station, and v are calculated. Using these quantities the principal and horizontal lines can be drawn on the picture as above explained.

Fig. 3—Methods of obtaining camera constants

the picture polygon can be secured by turning the camera always to the right. The camera is then leveled up and the number of the hole of the automatic spacer is recorded, as well as the time of day, the number of the film pack, and the number of the first film. The pictures are then taken, and a record is made of the number of each hole and film used. For future reference, the length of exposure and size of diaphragm are noted. The exact point where the camera was

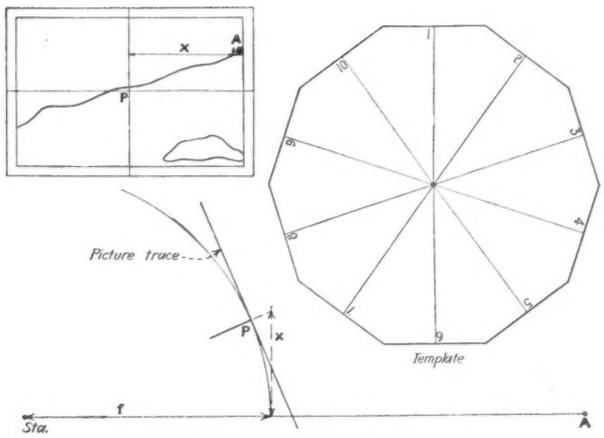


Fig. 4—Orienting the picture traces on the map

placed is either referenced to some prominent object or a signal is built up at that spot; then the next station is occupied.

It will readily be seen that a long base line is more desirable than a short, accurate one. For most purposes a hand stadia level is sufficiently accurate for measuring the base line. Photographic surveying is comparable with plane table work, the only difference being that the landscape is photographed and the photographs are taken into the office, and the map is compiled from the pictures upon a drawing board, instead of being drawn upon a plane table in the field.

At night the pictures taken during the day are developed. It is easy to develop and print the pictures in the field with the following equipment: a 4-oz. graduate, a glass stirring rod, one or more film tanks, a small printing frame, developing powders, acid fixing bath, Azo or Velox printing paper, and a gasoline lamp with mantels for printing pictures where electricity is not available. Many times a hotel room has been used to develop and print pictures on an examination trip.

Plotting the Survey

If a primary control has been used, it is computed and plotted, but if no control was used the base line is plotted. Next, the camera stations are placed on the map and the pictures are oriented and the traces drawn. They form about the station a regular polygon whose sides are tangent to a circle drawn with a station as a center and a radius equal to the focal length of the camera.

To orient the picture traces on the map, a circle is drawn with the station as a center and a radius equal to the focal length of the camera as previously determined. A picture is selected from the series about that station in which appears the perspective of some other point already plotted, such as *A*, Fig. 4. A line is drawn from this point to the station and a tangent to the circle is drawn where this line intersects it. The distance parallel to the horizon line is then laid off upon the proper side of this tangent. This new point is then connected with the station and a tangent drawn from the point where this line intersects the circle. This then is the oriented trace of the picture plane. The point of tangency is the projection of the optical center, and the line joining it to the center is the trace of the principal plane or principal ray.

As the automatic spacer has been used in taking the pictures, the angles between views are constant, so a templet cut from transparent celluloid can be used to orient the remaining pictures. After the first picture of a set has been located, the templet is centered over the station and rotated until the proper trace coincides with the oriented trace on the map, and the remaining traces are drawn in by drawing lines along the edges of the templet.

The next step in plotting the survey is the identification of the same points in different views. It is here that the beginner encounters his greatest difficulty, but with practice the topographer becomes skillful in identifying points and can find as many points as he needs for his work. Identical points are marked on the picture by a dot of red ink and a number; the same point is given the same number in each picture. After sufficient points have been identified to control the topography, the photographs are pinned down to a small drawing board and each point is projected parallel to the principal line to a strip of paper which is held parallel to the horizon line. (See Fig. 5.)

Each projection is given its corresponding number. The strips of paper with the optical center marked on them are placed upon the map with their edges over the corresponding picture traces and held in position by the use of small paper weights. Threads attached to bags of shot are held at the stations by means of needle points. To plot any one of the points, selected in the

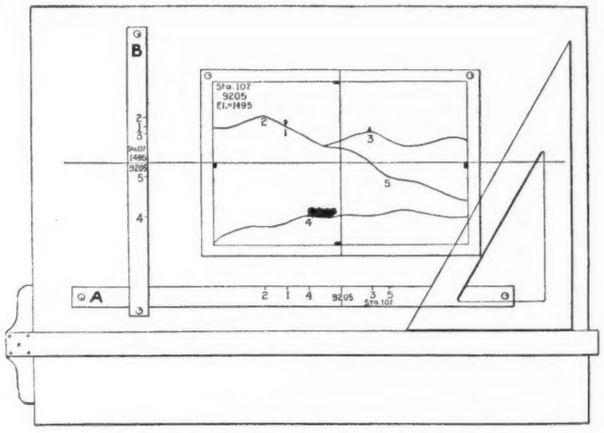


Fig. 5—Projecting points on the map

pair of pictures, a thread from one station is held over the number of this point on its strip of paper. The thread then represents the direction ray of that point. The same procedure is followed with the other thread held at the other station. The intersection of the two threads is the location of the point upon the map. A small dot is placed there and it is given its number. Similarly, all the points of the two pictures are plotted on the map. (See Fig. 6.)

Elevations

There are many methods which can be used to obtain the elevations of the plotted points. Only one, however, will be described in this paper. The elevation strips (see Fig. 5) are substituted for the plotting strips. The line on the strip indicating the horizon line is placed over the principal ray. The edge of the strip with the numbers on lies on the picture trace. A paper scale with the station elevation ruled across it (see Fig. 7) is moved with this elevation lying always on the principal ray parallel to the picture trace until one of the plotted points is at its edge. The thread from

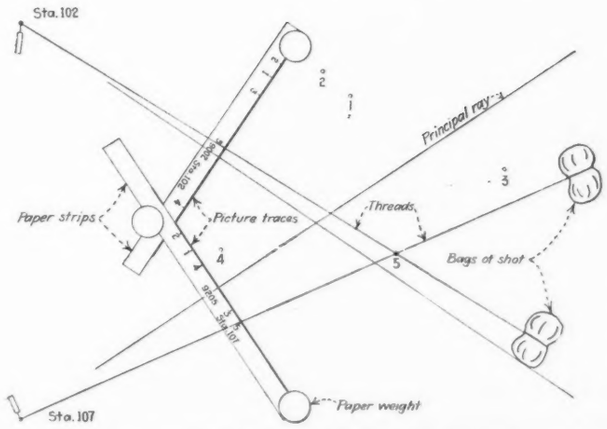


Fig. 6—Plotting points by intersection

its station is placed over the number of the point. The thread then occupies the position of the elevation ray, and where it crosses the scale the elevation of the point is read. By moving the scale toward or away from the picture trace, the elevation of all the points of that picture can be obtained. To check the elevation of these points the elevation strip of the other station can be used and a procedure similar to the one just described can be followed. Should the elevation of a point fail to agree within certain limits, some error in the plotting of the point, the identification of the point, or the figuring of the elevation has been made.

Contours

With the points plotted and the elevations figured, contours can be drawn by interpolating between the points as in other methods of surveying. It is often advantageous first to sketch the contours upon the picture and then draw them on the map. By so doing the small irregularities of the surface can be accurately followed.

By the use of descriptive and perspective geometry the location of contour points along ridges and up valleys can easily be located and plotted, both on the picture and on the map. Roads and lakes can be taken from single pictures, provided certain data regarding their elevation are known. The shore line of lakes and large bodies of water can be taken off a single picture by means of squares placed in perspective upon the photograph.

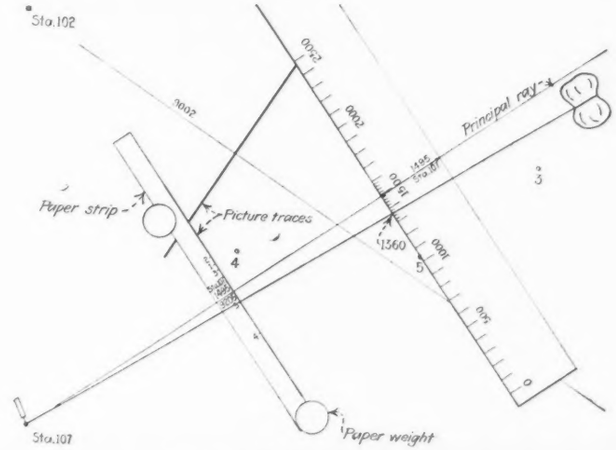


Fig. 7—Obtaining elevations

The unique feature about photographic mapping is that after proposed work has been laid out upon the map it can be projected back upon the picture, giving a clear idea of the location and quantity of work to be done. Such features as section lines in forested areas can be placed on the pictures and estimates of timber can be made and various projects visualized.

Cost and Speed of Work

It will readily be understood that the major part of the work of this method is done in the office. Some of the large-scale surveys require a day in the office for every hour's field work. It should be borne in mind that not more than two men are required in the field work, and only one man is needed in the office; hence savings in wages can be effected. In Canada, according

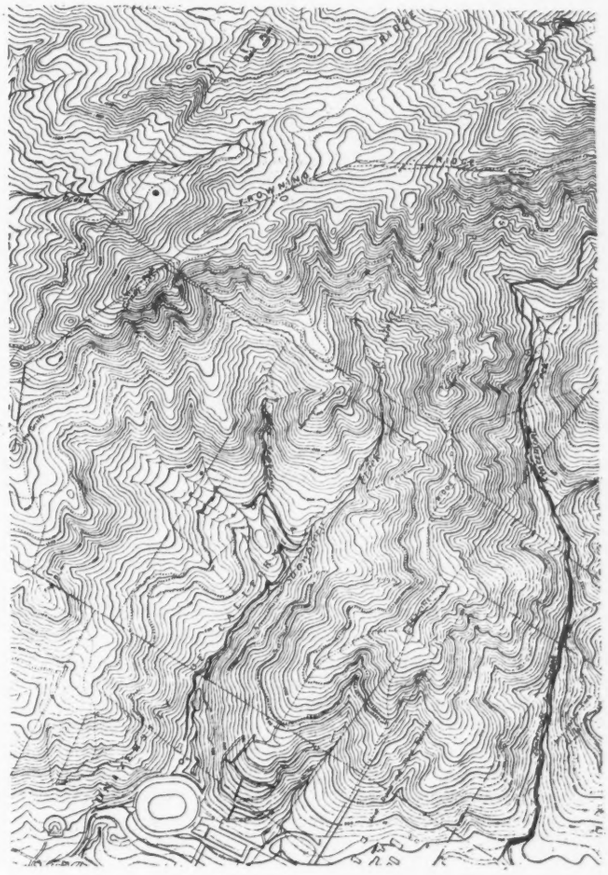


Fig. 8—Phototopographic map of part of Berkeley Hills, California

to E. Deville, the Surveyor General, one day in the field requires three days in the office. Reliable data as to the actual cost of photographic surveys and the time required in the field and office are lacking. Those who have used the photographic method of mapping agree that even if the cost of photographic surveying were equal to that of other methods the advantage would still be with the photographic method, because better maps would result. The topographer has views of the same territory from different viewpoints constantly before him while constructing the map, and is therefore able to show more accurately topographic features. My work indicates that the photographic method costs about two-thirds as much as the same work by other methods.

Fig. 8 is a photograph of a portion of a phototopographic map of the Berkeley Hills which was made during 1922 and 1923. It was plotted to a scale of 500 ft. to the inch with a contour interval of 20 ft., and covered an area of 10 square miles. In the north half of the map the control was established with the camera, but in the south half a transit control was used. Later, the control in the northern section was checked with a transit and found to agree to the minute with that established with the camera. The map was made for the use of the students at the University of California for geological field work.

A short list of the literature upon this subject follows:

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Laussedat, Aime: "Recherches sur les instruments, les methodes et le dessin topographiques." Paris, Gauthier-Villars, pt. 1, 1901; pt. 2, 1903.

Lemberger, Otto: "Stereophotographic Surveying." *Engineering News*, Vol. 69, pp. 602-612, 1913.

Flemer, J. A.: "Photographic Methods and Instruments." John Wiley & Sons, New York, 1906.

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Wright, C. W.: "The Panoramic Camera Applied to Phototopographic Work." *Trans.* A.I.M.E., Vol. 38, pp. 482-497, 1908.

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Rubber Tube Mill Linings Tried on the Rand

RAND metallurgists have been quick to try rubber linings for ball mills, as the following excerpt from the *South African Mining and Engineering Journal* will show.

The new use to which rubber may be put—that of liners for tube mills—has been adopted at Canadian mines for about a year. It was two years or so ago that experiments were first carried out on the Rand, but the conditions here are so different from those at the Canadian mines that the metallurgists have had to proceed with caution and make quite sure that so revolutionary a change would be justified. When applying the Canadian conclusions to Rand practice it has to be remembered that in South Africa pebbles and lumps of rock with a rough abrasive surface and sharp cutting edges are loaded in the mills in place of the smooth iron balls or rounded pebbles used in Canada. It was a question for consideration—or rather for demonstration—what the effects of this mass of rough pebbles and rock, weighing from eight to ten tons, would have on the surface of the soft rubber lining.

With a view to testing the suitability of the new lining for Rand conditions, a number of rubber bricks were interspersed between the steel liners on one or two mills at the Consolidated Main Reef and Geldenhuis Deep mines. It was soon found that vulcanized composition rubber was not so wear-resisting as softer pure rubber, and this latter was accordingly substituted. Although it is too early to say definitely whether or not this new lining will prove economical, it is admitted that so far as the experiments have gone they are distinctly encouraging.

The experiments are being continued. A subcommittee has been appointed by the Chamber of Mines for the purpose of investigating the matter thoroughly, and it is probable that a tube mill will be completely lined with rubber to provide a more complete test than the insertion of a few rubber bricks in a steel-lined mill can give. The cost of a rubber lining, however, is estimated at about £900, compared with £180 for the steel liner. Against this it is claimed by the advocates of rubber that this would give three times the life, and that it possesses many other advantages which would warrant the increased cost.

One claim made on behalf of the rubber lining is that, as a result of an improved method of fitting, there would be an entire absence of metal on the lining face and it would be impossible for gold to pocket itself between the lining and the outer shell, or between the plates of the liner, as occurs in the existing mills, where hundreds of pounds' worth of gold accumulates and is locked up for the six or eight months that constitutes the life of the liner.

Of course this "locked-up" gold is ultimately recovered when a new liner is fitted, but when it is remembered that there are over 300 tube mills in operation on the Rand it will be realized that the total amount of gold thus locked up for half a year is a matter of importance.

One objection that the Rand metallurgists had to the Canadian method of fitting the rubber liners was that this involved piercing the shell of the tubes and bolting on the rubber sheets. The South African Rubber Co. claims to have solved this problem by a patented method by which a mill could be completely relined in half a day.

If, as is estimated, this lining would last two years or more, the renewal would involve a stoppage of only half a day in the two years, compared with at least four days in the same period in the case of steel liners, each of which takes a full day to replace.

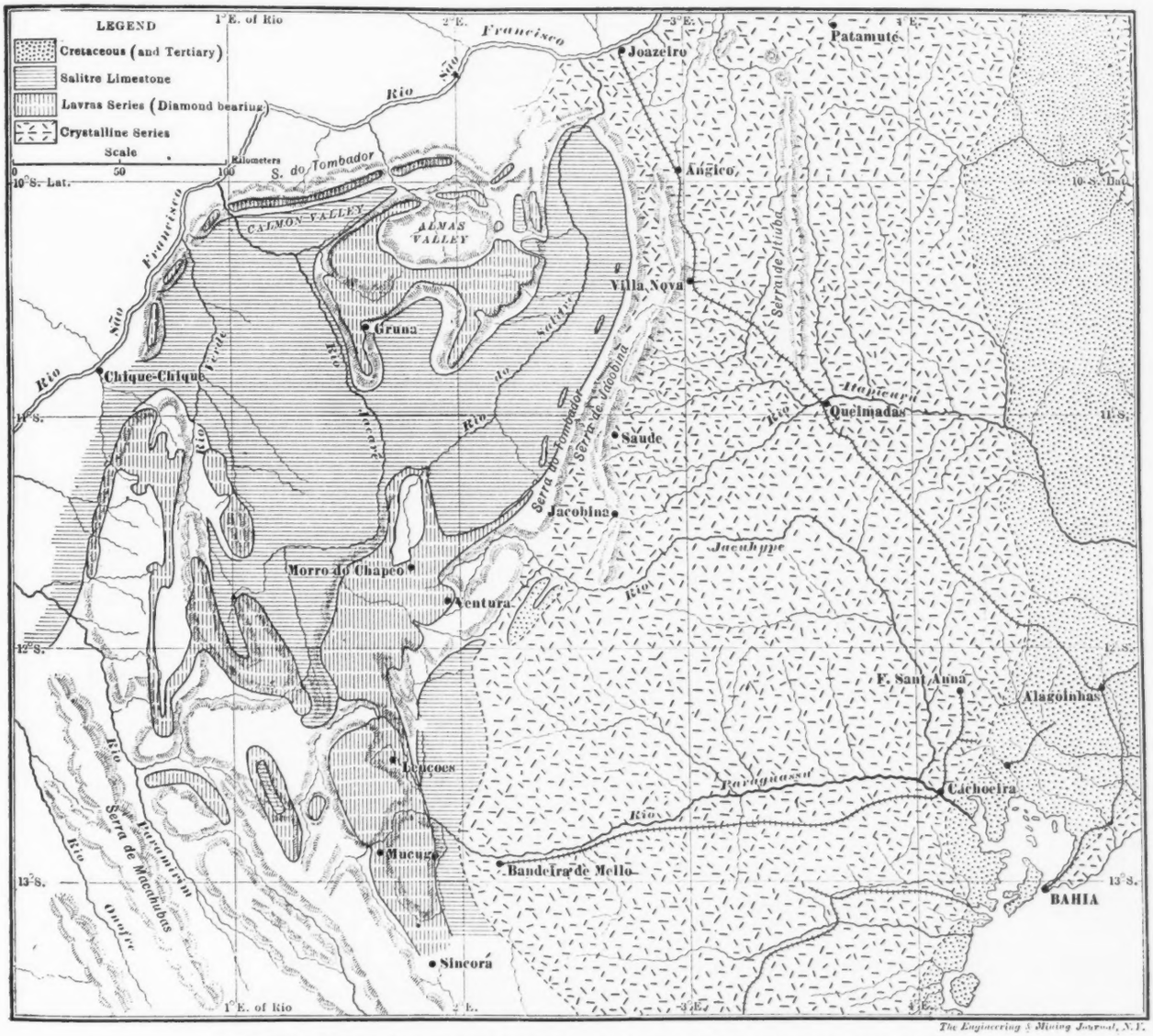
It is proposed to make the rubber liners about 1½ in. thick, or more than twice the thickness which has been adopted in the Canadian practice, but even with the increased thickness (which has been decided upon to insure a more efficient method of fixing in the shells) the capacity of the tube will be considerably increased as the present steel liners have a thickness of 4 in. the capacity of the tube will be considerably increased, 5 in. But the greatest advantage will probably be in the smaller power consumption in running the lighter mill, and the fewer stoppages—each of which means a loss of about 200 tons milled—if the longer life of the rubber lining proves anything like what has been estimated.

It was estimated that a saving in power of no less than 24 per cent was effected by the use of the rubber liner in the Canadian practice. The saving would not be so considerable in South Africa, as it is proposed to use very much thicker rubber lining; but even here the weight of the rubber lining will be only about one-eighth that of the steel lining.

Drill Diamonds, Carbons or Carbonados
Their Occurrence in Brazil

By F. Lynwood Garrison
Mining Engineer, Philadelphia, Pa.

THE INCREASING DEMAND for diamond drills in mining and engineering construction work and the superiority of the rotary drill for sinking oil wells, as well as the use of diamonds in certain varieties of machine-shop practice, has so increased the value of this material that its future supply is becoming a matter of concern. Carbons, to use the common trade name, are found in only one place in the world, a comparatively small area in the State of Bahia, Brazil, whose easily accessible deposits are now nearly exhausted by the primitive methods solely used heretofore in their recovery. As yet, no modern methods have been employed, and the relatively large areas of swamp and river bottom in which the diamonds occur are wholly unexploited. Branner[1] called attention to this fact as long ago as 1909, but so far as I am aware no steps have been taken to put this almost indispensable industry on a modern basis. The reasons for this condition are rather difficult to explain, as they are to be found mainly in the character of the country and its people, and the character of the government. It has been almost impossible to enlist outside capital and the requisite enterprise, and until this is accomplished, the supply of carbons is certain to become less and the price to reach prohibitive rates.



GEOLOGICAL SKETCH MAP OF THE CHAPADA DIAMANTINA OF THE STATE OF BAHIA, BRAZIL
Reproduced from "The Diamond Bearing Highlands of Bahia," by J. C. Branner, *Eng. and Min. Journ.*, May 15, 1909.

[1] *Eng. and Min. Journ.*, May 15, 1909.

As the subject under discussion is one about which very little is known, it is proper to preface further remarks with a few details regarding the physical properties of carbons:

Carbons Quite Different Physically From Brilliants

Carbon or carbonado, although of the same chemical composition as the white brilliant stones used in jewelry, possesses physical properties quite different from the latter. Neither is it the same as "bort," which

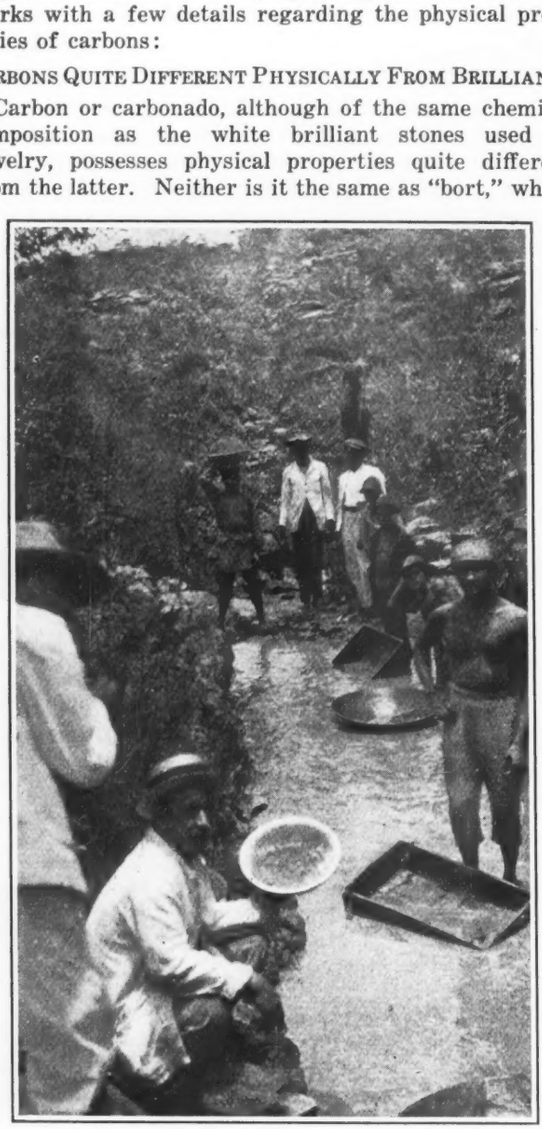


Fig. 1—The method of washing the diamond-bearing ground is primitive. In working the land deposits, they choose spots near the water and pan the sand and gravel in large wooden bateas, concentrating the first products in smaller ones

is commonly used as a trade name for chips, dust, waste, or byproducts chiefly from the diamond-cutting industry. Carbonado is the toughest, hardest variety of pure carbon, and is said by some investigators to be an amorphous, noncrystalline variety of diamond, possessing no cleavage and consequently very difficult to break. Some authorities claim it varies in hardness and cannot stand great heat without impairing its quality. According to Bauer[2], it is a finely granular to compact aggregate of minute crystals of diamond and is not amorphous; rarely absolutely compact, being more or less porous, resembling coke. When heated in water it gives off air bubbles expelled from the interstitial spaces of the mass. Although the cohesion is considerable, some samples are easily powdered. A microscopic examination of such comminuted material shows it to consist of very small octahedra of ordinary diamond, usually semi-transparent and containing small opaque inclusions of a light-brown color.

Owing to its vesicular character, carbonado has a specific gravity of from 2.750 to 3.416, whereas ordinary diamond is 3.52 to 3.55. Quartz is 2.6 and gold 19. It is important to bear these figures in mind when discussing, as will be done later, the question of dredging the diamond-bearing swamps and water-covered deposits along the Paraguassu River. According to Furness[3], the proportion by weight of the two kinds of diamond from this part of Brazil is three of carbonado to one of ordinary diamond.

Data as to Brazilian Production Scanty

Reliable statistics and technical data relating to diamond production in Brazil are very difficult to obtain. Up to 1849 the total output of diamonds in Bahia was assumed to be about 932,000 carats. In those early days the carbonado was supposed to be worthless and was thrown away. In 1915 the shipments from Bahia to the United States were 12,000 carats of rough diamonds and 3,800 carats of carbonado. It is probable that these figures approximate the present rate of production with a possible decrease in the volume of ordinary diamonds and some increase for the carbonado, due to the great advance in the demand and price of the latter. Owing to the small volume of this material, compared with its value and the unregulated manner of its production, there is no doubt that a large amount of carbonado is smuggled out of the country. Despite the vast increase in its value, a steadily decreasing production is inevitable, as the easily accessible gravel deposits are nearly exhausted and no modern methods are being used to recover the diamonds from the flooded and swamp areas, which apparently are of greater extent than any places heretofore worked. Of course, this is an assumption that has yet to be verified, for so far as I am aware, none of the underwater areas have been tested. Branner[4] remarks in this connection: "The native workmen have worked the ground right down to the edges of these swamps, but being unable to shut off the water, they have never been able to get at what is probably the richest of the deposits."

Value of Gravels a Matter of Speculation

The intrinsic value of the diamond- and carbonado-bearing gravels of Bahia is a variable about which it is difficult to obtain definite data. The following statements culled from note books represent the sum of my investigations upon the subject:

A good native workman will wash and concentrate, with the use of a wooden batea or bowl, one cubic yard of gravel (cascalho) per day when it is easy of access, uncemented, and handy to water. According to Darby[5], Pedro Benazet washed about one and a half cubic yards of gravel (decomposed conglomerate) selected for that purpose. The result of this operation was the recovery of a diamond weighing three grains—that is, about one carat (3.17 grains troy = one carat). Darby does not say whether it was an ordinary diamond or a carbonado. As the latter occur *in situ* only in this Lavras conglomerate, I assume that the stone was carbonado. It is my impression that Darby did not cite this test with

[2]Edelsteinkunde, Max Bauer, Leipzig, 1896, p. 201.

[3]*Popular Science Monthly*, Vol. 69, 1906, p. 272.

[4]*Eng. and Min. Journ.*, May 15, 1909, p. 986.

[5]*Economic Geology*, Vol. 1, p. 141.

a view of giving it out as a definite average of value for these diamond-bearing conglomerates or gravels. As carbonado is worth perhaps $90 to $100 per carat, and as there are many millions of cubic yards or tons of these detritals in the so-called Chapada Diamantina, the value of the stones contained would be fabulous. I am quoting these and the following figures as the only available data I have been able to find, and they must not be used or misused for promotion purposes.

In South Africa a full load of "blue ground" weighs about 1,600 lb. Spread out about a foot in thickness, such a load covers about 21 square feet. Boutan[6] collected statistics dealing with the blue ground at Kimberley from 1881-1884, showing that it then varied between 3.04 and 7.17 carats per cubic meter (1.3 yd.), which in those early days no doubt represented the richest known ground, as an average. In fact, this authority says that the mean yield was about 4.55 carats per cubic meter, or about 3½ carats per cubic yard. At the De Beers mine, during the same period, the yield was 3½ carats per cubic meter of rock in the richest ground, and the general average was between 1.28 and 3.52 carats. In later years these averages became much less, running in the Bultfontein around 0.20 and in the Premier 0.30 carat. Ball[7] says that kimberlite (blue ground) carrying only 0.05 carat per load has been profitably milled. He also remarks that the alluvial of gravel mines is of higher grade than that of pipes (blue ground) and that, on account of the smaller specific gravity, diamonds have not undergone in alluvial deposits, except in rare instances, such extreme concentration as gold.

According to Crandall[8], in the Morro do Chapeo section of Bahia the carbonados are much more important than the diamonds, the size of the diamonds varying directly with the coarseness of the conglomerate.

Productive Area Limited

As previously mentioned, carbonados are found in only a comparatively elevated area of the State of Bahia, about three hundred miles west and northwest of the city of Bahia. It is most easily reached by the railroad running west from Cachoeira, a small town on the lower Paraguassu River a short distance from where it flows into the bay, to Bandeira de Mello, where the topography becomes rougher and construction costs increase correspondingly. The geology of this district, the Chapada Diamantina, has been described by several writers, notably in the original observations of Darby[9], Branner[10], and Crandall[11]. A detailed discussion of the subject in this connection would therefore seem needless, and moreover, I had not an opportunity of studying the subject on the ground, so that any criticism on my part other than a few general observations would be presumptuous. My young friend, Charles E. Ivers, of New York, spent several months on the upper Paraguassu investigating the industry, and I am indebted to him for the photographs accompanying this article. Not being a geologist or mining engineer, his observations are of a non-technical character.

The outstanding fact in connection with the economic geology of the subject is that the carbonados are found only in stream beds and old stream deposits, which have derived their detritus from the erosion of certain quartzites and conglomerates of what is known as the Lavras series, of possible, if not probable, Carboniferous age, but as no fossils have yet been found in them their geologic period is uncertain. The Lavras rocks are all sedimentaries, and are generally of a pinkish

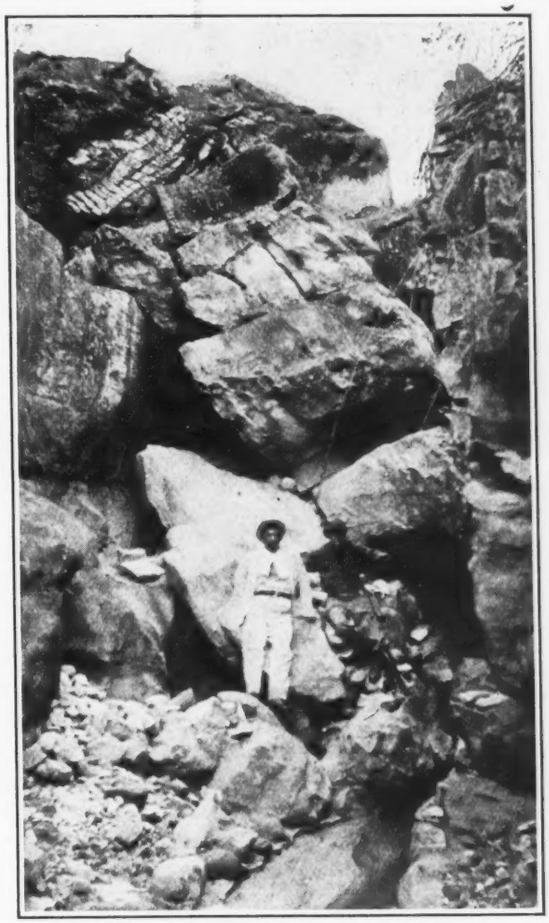


Fig. 2—At Piruca, on the Paraguassu, where thirty-six men in two weeks are said to have taken out $3,000 worth of carbonados

color. No eruptive rocks have been observed in the regions where the carbonados are found. The origin or genesis of the carbonados is therefore uncertain, if accepted theories regarding the genesis of the diamond are to be applied to this particular variety of mineral carbon. Branner[12] was disposed to believe they had their origin in the quartzites of the Lavras series. Darby seemingly favored this view, and Crandall, as far as I am aware, has expressed no opinion upon the subject.

Despite this situation, the easiest and most logical view would be to regard the diamonds and carbonados as an integral part of the original sediments which compose the Lavras beds. Whence these ancient detritals were derived is not known, but we are well aware of the fact that the elevated district known as the Chapada Diamantina is a sort of island or patch in a

[6] See Bauer (English translation), p. 206.
[7] *Eng. and Min. Journ.*, May 29, 1920, p. 1208.
[8] *Economic Geology*, Vol. 14, p. 229.
[9] *Economic Geology*, Vol. 1, p. 134.
[10] *Eng. and Min. Journ.*, May 15, 1909.
[11] *Economic Geology*, Vol. 14, p. 220. An excellent bibliography of the subject will be found in the work on the "Mineral Deposits of South America," by Miller and Singewald, New York, 1919, p. 218.
[12] "Minerals Associated with Diamonds and Carbonades in the State of Bahia, Brazil." *American Journal of Science*, Vol. 31, June, 1911.

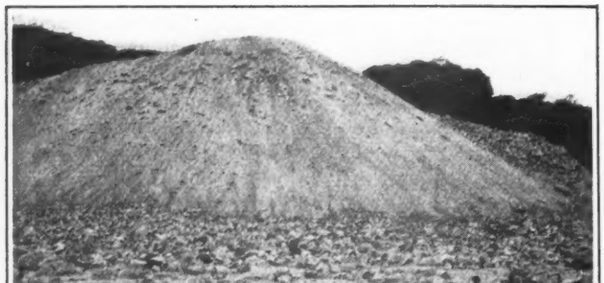


Fig. 3—Tailings from gravel washing operations

vast Pre-Cambrian area which constitutes an enormous part of Brazil south and southeast of the Amazon River. It is much like the Pre-Cambrian shield of eastern Canada, and one may well believe contains similar mineral potentialities.

There is no reason to assume or suppose that the Brazilian diamonds and carbonados had originally a different origin from those diamonds found in many other parts of the world, which it is now fairly well established were formed or had their being in peridotites (serpentine) and other allied types of heavy basic magma. Although Branner believed that they originated in the quartzite, it seems clear that he was not wholly sure of this view, because he mentions in connection with the subject that he had found a considerable area of serpentine in the crystalline rocks which underlie the sedimentaries of the diamond region. He does not indicate the exact localities[13]. It is, however, now well known that serpentine occurs at the chrome deposits of Campo Formoso and Santa Luzia in the Pre-Cambrian area a few miles east of the Chapada Diamantina. Branner was not, however, aware of the existence of the chrome deposits until after I reported their discovery in 1916[14].

Continued Reduction of Output Seems Inevitable

It seems evident, from what it has been possible to learn regarding present conditions in this diamond-bearing region, that the limit of production by the present primitive native methods of operation is long since passed and a continued reduction of output is inevitable. It is true that the productivity of the different districts of this region has varied for diverse reasons, such as the faulting and enfolding of the Lavras beds, the denudation of their anticlinal folds, and the burial of the synclines beneath later deposits. "In some cases the diamond-bearing beds outcrop along narrow zones for long distances; in others they widen out over areas covering hundreds of square miles, and in still others they are mere remnants of original beds[15]."

Then, too, the absence or abundance of water for washing operations has had a direct effect upon the relative productivity of the different areas. The Chapada Diamantina is in a part of Brazil which experiences severe drouths, although in the highlands of the interior the rainfall is much more abundant, and the stream flow is consequently considerable and variable, but is usually well maintained except in the dry season. The result of such conditions has been that wherever the natives have found soft spots, pockets or beds of the Lavras rocks which could be disintegrated and scraped out, the loose material (sands and gravels) thus obtained, as well as that from the natural weathering, was sorted, carried to the nearest water, and washed with painstaking care, often with gratifying results in accord with their modest expectations. See Fig. 1. Sometimes these operations develop on a large scale, and great quantities of material are moved, as shown on the cover and in Figs. 2 and 3, and caverns have resulted from the gouging out of the unconsolidated material in the enfolding rocks.

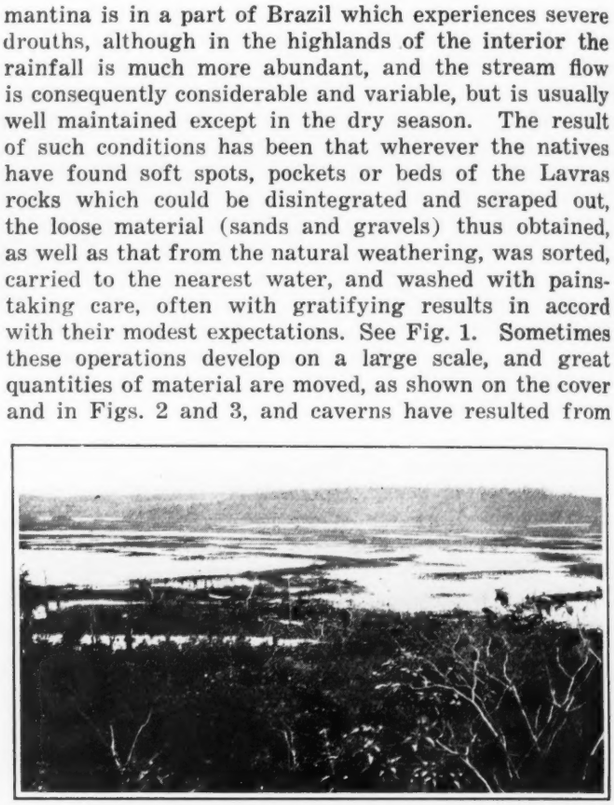


Fig. 4—From Genipapo to Garapa the road follows the swamp for five miles

Carbons Formerly Wasted

The natives are, of course, well aware that the beds of the streams which drain this region are full of diamond-bearing detritus which has resulted from the natural decay of the pink Lavras formation. As this erosion has been going on for a very long time, even in a geologic sense, the amount of such material must be tremendous. In a letter written to me after my return from Brazil[16]. Dr. Branner remarks "In the early days of diamond washing at Lencoes and Andarahy the carbonados were not saved, because it was not known that they had any value. They therefore went into the adjoining swamps with other tailings. When it became known that they were valuable the miners went on with their work in the old way, but saved the carbonados, and the tailings still went into the swamps. The region is mountainous to the west and low and flat to the east. The rains swell the streams and carry the tailings further out of the reach of the miners, who use only the old crude methods of washing. They cannot handle anything below water level. The low flats into which these tailings went, and into which the diamonds themselves were carried before mining began, extend ten miles or more along the Paraguassu. From Genipapo to Garapa the road follows the swamp for five miles. How deep the deposits are and what sort of bottom they have no one knows." See Fig. 4.

The bars, beds and associated swamps of the large streams like the Paraguassu undoubtedly contain great

[13]"The Diamond-Bearing Highlands of Bahia"; J. C. Branner, *Eng. and Min. Journ.*, Vol. 87, May 15, 1909, p. 985.

[14]In a characteristic letter to me dated Nov. 14, 1916, Dr. Branner observes, "A person well posted on the geology of Brazil sits up and takes notice whenever serpentine is mentioned, for it is supposed to have some genetic relation to the diamonds. I have only seen it in one place in Brazil, and if you know of occurrences, my suggestion is that you look it over carefully."

[15]J. C. Branner, *Eng. and Min. Journ.*, Vol. 87, May 15, 1909, p. 985.

[16]Aug. 24, 1920.

quantities of detrital material assumed, if not actually known, to contain large quantities of carbonados. There is in this region probably a large and certainly the only known reserve of this valuable material, now almost indispensable for future mining and engineering purposes.

Diamonds are reported to have been found in the gravels of this river as far down as Bandeira de Mello, the present terminus of the railroad and some miles east of the point where the Paraguassu leaves the sedimentaries and debouches into the Pre-Cambrian area that extends thence to the sea. The natives have made continual efforts, during the dry seasons, to work these under-water deposits. The methods are almost pathetic in their crudeness and simplicity, as may be seen by the photographs in Figs. 5 and 6. Nowhere have they reached bedrock, although sometimes the recovery has been of considerable value, as for instance in the operation illustrated in Fig. 2 at Piruca, on the Paraguassu, where thirty-six men in two weeks are said to have taken out $3,000 worth of carbonados, an equivalent of about $6 per day for each man—a great deal of money to them.

The operation shown in Fig. 1 is at a water hole at Andarahy, in the highlands back from the river where the miners scrape out and sort over the loose,

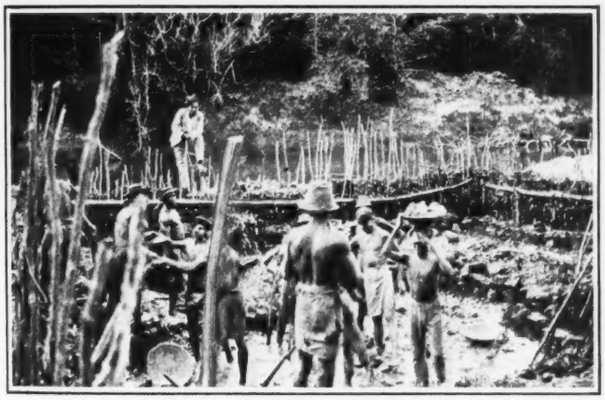


Fig. 5—Excavating on bank of river by constructing flimsy dams. Bedrock cannot be reached by this method

unconsolidated decomposed material which they find in the pockets, crevices, and talus of the Lavras rocks.

Development of Under-water Deposits Awaits Modern Enterprise

Plans for the development of these under-water deposits have been worked out in a general way, but details, questions, of title or mining rights, transportation, and other factors, await the advent of an adequately financed, well-organized, and intelligently directed enterprise. Mining operations in Brazil are fraught with serious difficulties, aside from those of a physical character; it would be unfair if those of us who know anything about them were to dissemble. The laws, federal and state; mining regulations, time-honored customs, as well as the psychology of the people, are factors to be carefully studied and considered. The people of the interior, rich or poor, black and white, are kindly, hospitable, and seldom unfriendly. Officials are nearly always venal, dishonest, and unreliable; underpaid and resorting to all manner of graft in order to make a living.

The diamond region of Bahia is not a wild, unsettled wilderness, but an old, well-established community, where much, if not most, of the land and many privileges have been in the possession of a few families for generations. The leading people are, of course, the land owners, who are comparatively rich and hold somewhat of a patriarchal relation to the lower or laboring classes, who are the miners, cattle men, and the cultivators of the *fazendas*. Although these people lead narrow and provincial lives, and are correspondingly uneducated and a law unto themselves, they are kindly, hospitable, and not as a rule averse to having their country developed provided they share fairly in the resulting benefits—a perfectly proper and reasonable condition. On the whole, these *fazendeiros* are the hope of Brazil and impress one very differently from the average degenerate city dweller and official with whom the American tourist and visiting engineer come most frequently in contact.

An Opportunity of Prime Importance

Knowing, as we do, that there must be large reserves of carbonados and diamonds in these stream beds, bars, and swamps, that it is the only place in the world where the carbonados may be obtained, and being also familiar with the cheapness and facility with which such gravels and sands can be handled by various mechanical and hydraulic means, it is reasonable to assume that conditions afford an engineering and mining opportunity of prime importance. That the profits should be large seems certain. Carbons, to use the trade name, are now worth between $90 and $100 per carat, if not more for the best stones (some as high as $150 per carat). Such being the case, the possible profits would be large if not enormous, and the question naturally arises, why has not this great opportunity been realized and exploited? My answer is that the production and marketing of carbonados is a comparatively small business, about which very little is known by the general public. It is almost wholly in the hands of a few obscure traders and brokers of foreign extraction, jealous of their knowledge of the trade; themselves unprogressive, unimaginative, and fearful of large and expensive undertakings. Moreover, such projects require the spirit of daring that is a prerequisite to successful engineering enterprises in any foreign country. Unless something of the kind is soon developed, some substitute for the diamond drill must be found or developed, which is likely to be a difficult thing to do.

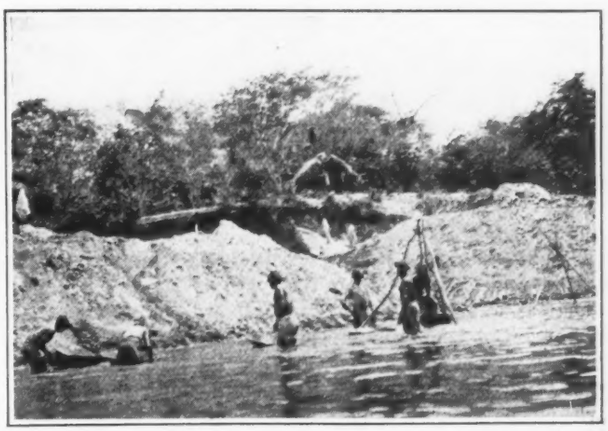


Fig. 6—Men washing gravel in river

Marketing of Antimony

Methods of Selling One of the Few Metals for Whose Supply the United States Is Dependent Upon Other Countries

By Harris K. Masters
Wah Chang Trading Corporation, New York

AS THERE IS NO ANTIMONY MINING or smelting industry in the United States, and no production of refined antimony direct from either domestic or foreign antimony ores, the marketing of antimony is immediately placed on quite a different basis from the marketing of those other metals which are mined and refined in this country. Practically all of the refined metal, known in the trade as regulus, consumed in the United States is imported from China. The importer sells metal either direct to consuming interests or to dealers. The usual minimum import lot is twenty-five gross tons.

Most of the metal imported enters through the Port of New York and, if purchased for "shipment from China," is usually sold to the buyer in bond and ex dock, Port of New York. Those buyers who do not wish to purchase on this basis buy duty-paid and f.o.b. railroad cars Port of New York for shipment to their works or distributing points. The metal is retailed in practically every large city in the country by the makers of white-metal alloys, by smelters of secondary metals, and by general dealers in metals.

Contracts Bind Buyer and Seller

When the market is active sales are made by telephone or telegraph, offers being made for immediate acceptance. When the market is steady and not fluctuating, this business may be done by letter offers and replies.

Contracts are usually written by the seller and cover the brand or grade of the metal, the position or month of shipment (either from abroad or from New York), the terms of sale, and invariably include a "force majeure" clause. Owing to the fact that the metal is all imported, sales are seldom made for "arrival," because of the uncertainty attending arrival dates of steamers carrying goods, but are almost invariably for shipment during specified month or months from abroad or from New York.

The retailers sell ex store or delivered to their buyers. In the latter event the price includes the cartage charge. Prices are rarely quoted at differences of less than 0.05c. per lb. and in an active market these differences are rarely less than ½c.

Terms, in the case of import orders, are usually cash on arrival of steamer carrying goods, or the buyer opens letter of credit at 90 or 120 days' sight, available for use of the foreign shipper. Local sales are almost entirely for cash in New York funds against shipping documents and invoice. There is little or no consignment business. Shippers in China do not consign metal to their New York connections, nor do the New York importers and dealers ship to their buyers in the interior on a consignment basis.

The principal market is naturally in New York, and out-of-town buyers purchase either through their New York offices or sales agents, or employ the services of brokers, to whom the seller then allows a brokerage of three-fourths of 1 per cent. The principal importers are those with well-established connections in China, and only under abnormal conditions are any importations made in Europe. The largest producing firms in England have selling agents in New York and do import a small tonnage of their highest-grade product for certain special uses.

The U. S. Geological Survey estimates the average world's yearly peace-time consumption of antimony from ore produced, not including antimonial-lead ores, at about 22,000 metric tons, and that of the United States, 10,000 tons. The United States uses also 2,100 tons of virgin antimony contained in antimonial lead of domestic smelting and 3,500 tons of secondary antimony recovered from alloys, scrap, dross, and other waste material, a total of 15,600 tons.

Antimonial Lead for Storage-Battery Manufacturers

In the United States there is a considerable production by the smelters of antimonial lead, which contains from 15 to 20 per cent antimony, from one-quarter of 1 per cent to 1 per cent copper, and from one-quarter of 1 per cent to 1 per cent arsenic. The average annual production of this material is about 15,000 tons and the principal consumers are the storage-battery makers. The battery metal which they produce from this antimonial lead contains from 3 to 6 per cent of antimony, with small fractions of copper and arsenic. The price of antimonial lead varies with market conditions and with the content of impurities. Recently, and since the exhaustion of the heavy supplies of shrapnel balls in the hands of the governments involved in the Great War (these contained about 12 to 13 per cent antimony), the price has been about ¾c. below the price of pig lead.

It seems probable that from now on the price of antimony will be a greater influence than it has been during the last few years, and assuming a differential of ½c. below the pig-lead price, as fair for antimonial lead, with lead and antimony priced about the same, then, when and as the price of antimony advances above the lead price, this differential should tend to disappear, and it is quite conceivable that conditions might warrant antimonial lead selling at a price above the pig-lead price—as indeed it has several times in the past.

When the market is sufficiently high there is some importation of antimony ore, principally from Bolivia and Mexico. This ore is usually sold to smelters of antimonial lead or to manufacturers of antimony sulphurets, crimson and golden, used by the rubber trade, and is purchased by these consumers whenever the ore can be bought to advantage as a substitute for the crude, or needle, antimony, which is regularly imported. Crude, or needle, antimony is the liquated sulphide containing a minimum of 70 per cent antimony, imported principally in lump form, but occasionally finely ground for use by manufacturers of antimony oxide and other antimony compounds. There is also a fair tonnage of imported oxide, which is sold by the importers and

dealers in chemicals for consumption in the enameling trade and chemical industries.[1] One domestic manufacturer produces a considerable tonnage of oxide from imported crude and ore.

During the war, the Department of Commerce in its Census of War Commodities reported the percentage consumption of antimony in the years 1917 and 1918 for various uses as follows:

Percentage Consumption of Antimony, 1917, 1918

	1917	1918
Babbitt metal	29.7	28.1
Hard lead, including pipe, traps and similar ores	11.1	12.2
Soft metal alloys and solder	8.9	10.2
Type and type metal, linotype, electrotype, stereotype	8.7	6.8
Vulcanized r bber and rubber goods	7.1	8.4
Shrapnel and other bullets	7.0	11.7
Bearing or anti-friction metals not elsewhere specified	6.6	6.5
Battery plates	6.1	4.8
Enamel on metal ware	4.6	3.3
Cable coverings	2.7	1.1
Chemicals, paints and pigments	2.5	2.3
Brass, including bronze	1.0	0.8

These uses accounted for 96 per cent of the consumption of antimony, the rest being distributed over a number of products such as white metal and alloys, foil, collapsible tubes, britannia metal, casket, carriage and other hardware and lighting fixtures, primers for explosives and miscellaneous uses. Were an accurate census to be made today it would, of course, be found that the demand for shrapnel and other bullets had greatly diminished, and that the consumption for hard lead, battery plates, rubber and rubber goods, enamel on metal ware, and cable coverings had considerably increased.

Most Important Consumers Are in the East

The principal industries using antimony products as raw materials are clearly indicated by the accompanying table. These industries are situated principally in the northeastern part of the United States, and very little antimony is consumed west of the Mississippi River. There is a small consumption on the Pacific Coast, but the principal distributing centers are New York, Chicago, St. Louis, Philadelphia, Cincinnati, Detroit, Baltimore, Cleveland, Boston and Pittsburgh; on the Pacific Coast, San Francisco and Seattle.

The demand for antimony is not a seasonal one, although it is, in common with other metals, effected by the custom prevailing in many industries of contracting sales of their products for the first half or second half of the year, or for the different quarters of the year, which naturally leads to the purchase of metal supplies at the time such contracts are being written. The market is usually more active in the winter and early spring, and again in the fall. Much depends of course upon activity in certain industries requiring those alloys of which antimony is a component part, as, for instance, the automobile industry, with its tremendous use of bearing metals and storage batteries, and the rubber tire industry, with its consumption of antimony compounds for vulcanizing.

Specifications Not Critical

The only specification for metal or regulus is that it shall contain a minimum of 99 per cent antimony, as little arsenic as possible, and be uniform in quality. As the source of supply is in China, and as the Chinese smelters do not guarantee their product except as to antimony content, the drawing of any severe specification for impurities is not practicable, and the proper preparation of mixtures must depend upon analyses made in the laboratories of the works using the metal. There are no special physical requirements, and this is because the metal is not used alone in its refined condition but is always remelted and alloyed with other metals. All that is required is the standard content of 99 per cent antimony and a clean "starred" slab of metal of a convenient size to be broken up and thrown into the melting furnace.

The Chinese regulus is imported in cases containing 224 lb. net of metal in the form of slabs weighing 30 to 40 lb. each. English regulus comes in casks containing 672 lb. The buyer is likely to judge the quality of the metal he buys by the surface appearance of the slab. A clean slab should show those fine crystalline forms which are known to the trade as the "star" and which give rise to the term "Star Antimony." This appearance is produced by carrying on the final refining of the metal under a surface of fluxing material. Though material produced in this way and showing the recognized "star" is usually high-quality material, it is possible to produce metal of superior quality without starring. However, the trade demands the star, and the metal is consequently produced in such a way as to show this appearance.

Some European Brands Disappearing from American Markets

In the American market there are two classes of buyers. The first is satisfied with the ordinary 99 per cent regulus and the second requires a higher content. The ordinary brands constitute probably 85 to 90 per cent of the total sales. The demand of the higher class trade is satisfied by the purchase of such superior quality metal as Wah Chang's "WCC" Chinese antimony or Cookson's "C" brand. The other European brands which formerly came into the American market, such as Hallett's "H," "ASP," and French "HH," have practically disappeared from the American market, having been displaced by Chinese metal.

When the metal is imported no samples are taken. It is sold simply as prime antimony 99 per cent pure, and invariably contains the guaranteed percentage of antimony. Of course, sampling and analysis is necessary at buyers' works whenever the buyer's process requires that the percentage of impurities should be definitely known. For anyone interested in methods of sampling and analysis reference may be made to the excellent article by W. A. Cowan on "The Metallurgy of Tin and Antimony," published in Volume VIII, 1914, of the *Transactions* of the American Institute of Metals.

In the American market the price is always quoted in cents per lb. and in the European market the basis is the price in pounds sterling per gross ton of 2,240 lb. The average price in New York of antimony metal for thirty years ending in 1914 was 7.50c. per lb. for Cookson's brand. Since that year the Chinese metal has come to dominate the market in the United States. Chinese ordinary brands of 99 per cent metal have averaged in price as follows (*E. & M. J.* and *E. & M. J.-P.* quotations):

	Cents per Lb.		Cents per Lb.
1915	30.28	1920	8.48
1916	25.37	1921	4.96
1917	20.69	1922	5.47
1918	12.58	1923	7.90
1919	8.19		

When considering the question of antimony prices it should be borne in mind that China is a silver coun-

[1] The standard specifications for the oxide is that it shall be of good white color and 98 to 99 per cent soluble in hot tartaric acid.

try. Its domestic transactions are all done with silver coins, and the value of its produce in the world's markets on a gold basis fluctuates as does the gold value of silver, upon which its foreign exchange transactions are also based. In other words, if the cost of a ton of antimony, f.a.s. vessel, Shanghai, China, remains fixed, then its cost, c.i.f., New York or European port, assuming freight and insurance charges also fixed, will vary with the market quotation for silver, rising as silver advances in pence or cents per ounce and falling with a reverse movement.

The Tariff

Since Sept. 21, 1922, the date of the signing of the Fordney-McCumber Tariff Act, there has been an import duty on antimony metal or regulus of 2c. per lb., on needle or liquated antimony, ¼c. per lb. on oxide 2c. per lb., and on sulphides and other antimony salts and compounds not specifically provided for, 1c. per lb. and 25 per cent ad valorem.

The corresponding rates in the Underwood tariff effective Oct. 3, 1913, were 10 per cent ad valorem, 10 per cent ad valorem, 15 per cent ad valorem and 15 per cent ad valorem (the intent of this bill was to apply a duty of 25 per cent on the last two named items, but through an error in punctuating the bill the actual duty paid was only 15 per cent).

Under the Payne-Aldrich bill of 1909 these rates were 1½c. per lb., 1c. per lb. on the antimony content, 1½c. per lb. and 25 per cent ad valorem (salts and compound of antimony were not specified prior to 1913). There was no opposition to the rates in the Fordney-McCumber bill by either consumers or importers, who generally considered the cost of the tariff to the ultimate consumer would be insignificant and that it would provide some revenue at a minimum of inconvenience to the public. It was fully recognized that there was no domestic antimony industry worthy of protection, although at the last minute provision was made to protect one small industry using needle or liquated antimony as its raw material, by reducing the rate on this product from ¾c. to ¼c. per lb.

The Fordney-McCumber bill has now been in effect for twenty-one months and no change whatsoever in conditions attending antimony in the United States has resulted, other than the increase in price to the domestic consumer.

Antimony Ore Imports for Chemical Purposes

Because there is no antimony-smelting industry in the United States producing refined metal direct from ores either domestic or foreign, very little ore is imported into this country and practically no ore has been mined here since 1920. Such imports as arrive are destined either for those smelters producing antimonial lead, and are sold at prices dependent on the market for this alloy, or for chemical manufacturers who use ore as a substitute for crude or needle antimony. In the latter case the price is a matter of individual agreement.

Abroad, the principal market for antimony ore is in England, where the smelting and refining of these ores has been long practiced by such companies as Cookson & Co., Ltd., Hallett & Son, the St. Helens Smelting Co., Ltd., and others, drawing their supplies principally from China, Mexico, and Bolivia.

The standard ore is the sulphide or stibnite, and the price obtained depends upon the percentage of antimony and of those elements considered as impurities because of their effect on the quality of the metal produced and the difficulty of eliminating them in the smelting and refining process. The minimum percentage of antimony usually desired is 60 per cent, but down to 50 per cent is salable if otherwise of good quality. Usually, sulphide ores are preferred, but oxides are taken by some of the buyers, generally at a slightly lower price, although oxide ores will be received containing below 50 per cent antimony at a correspondingly heavier deduction from the base price. As is usual in the smelting practice of the white metals, coarse ore is preferred to fine, and ores with siliceous gangue to those of a pyritic character.

The objectionable impurities are lead, copper, arsenic, zinc, and bismuth. These are penalized as follows:

Lead up to 0.3 per cent, free, with an allowance to buyers of 5s. per ton of ore for every 0.1 per cent or part over 0.3 per cent up to 1½ per cent. Some buyers stipulate that lead must not exceed 0.3 per cent. Arsenic, 0.1 per cent free, with an allowance to buyers of 7s. 6d. per ton of ore for every 0.1 per cent or part in excess of 0.1 per cent up to 0.5 per cent. Copper carries the same deductions as arsenic, although some buyers stipulate that no copper should be present in the ore. Zinc and bismuth are considered very objectionable impurities, and should not be present in more than traces. If present in amount up to say one-half of 1 per cent, the price of the ore would be subject to heavy deductions, which would depend largely on the other constituents of the gangue.

The base price of course fluctuates with the market price of refined metal or regulus, but there is no definite ratio between the selling price of regulus and the unit price of antimony in ore. In all of these details the negotiation between buyer and seller based upon the market conditions at the time, supply of and demand for ore, ultimately fixes prices and terms. In normal times ample supplies of ore practically free from the impurities named are available in the United Kingdom, and consequently only such ores would be salable there. Parcels offered for sale should be of at least fifty tons, although smaller quantities are salable.

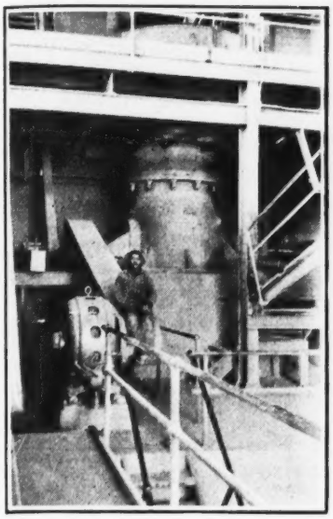
Weighing and sampling are done at buyers' works, and usually a 10 per cent sample is taken. Assays are compared and agreed as usual, and payment is usually made fourteen days from date of sampling. If business is done through a broker, a commisson or brokerage of 1 per cent is paid.

Mineral Output of Cripple Creek

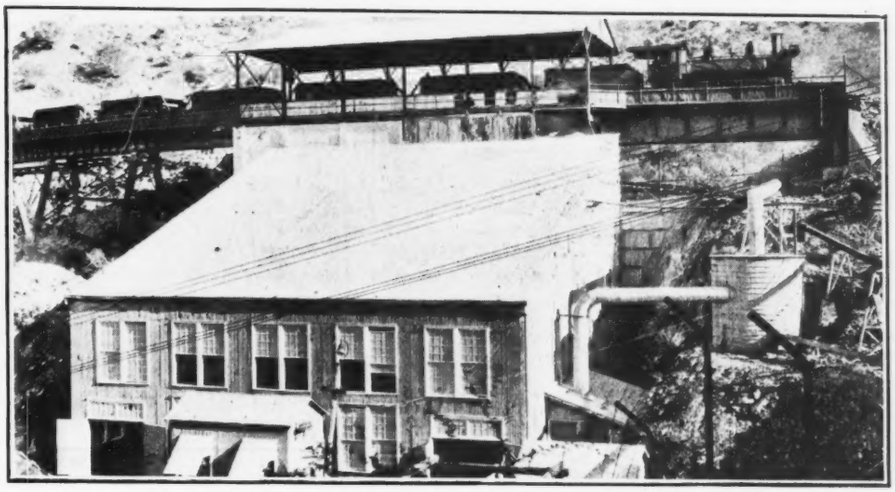
During the first six months of 1924, the Cripple Creek district has produced $2,300,000 in gold, or at the rate of $4,600,000 a year, as compared with $4,065,545 in 1923, according to the U. S. Geological Survey. The output from Cripple Creek for the second six months will probably be higher than that for the first six months, owing to the progress that is being made in the district. The Cresson mine will probably maintain if it does not exceed its regular monthly output of 10,000 to 11,000 tons.

The Portland mine, now relieved of debt by shipments from its 2,600 level and by the profitable operation of its cyanide-concentration mill, will probably be able to combine mining ore and sinking to 3,000 ft.; the United Gold Mines Co. has opened much ore in its properties; and the reopened Stratton Estate mines may become shippers before the end of the year.

Equipment at Moctezuma Copper Co.'s Concentrator, Nacozari, Sonora

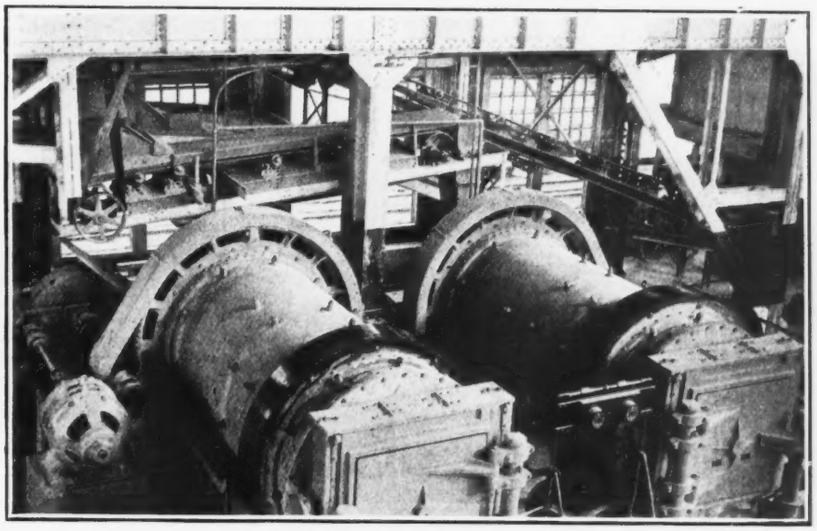


No. 4-F Telsmith crusher

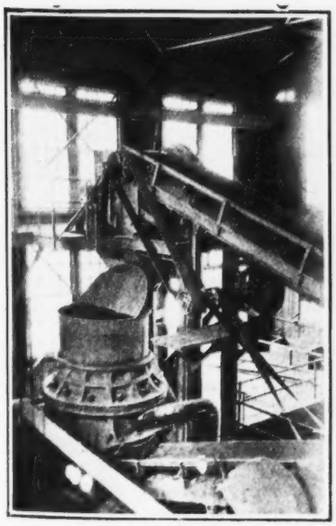


Coarse-ore bins and coarse crushing plant, with dust-collecting system at right

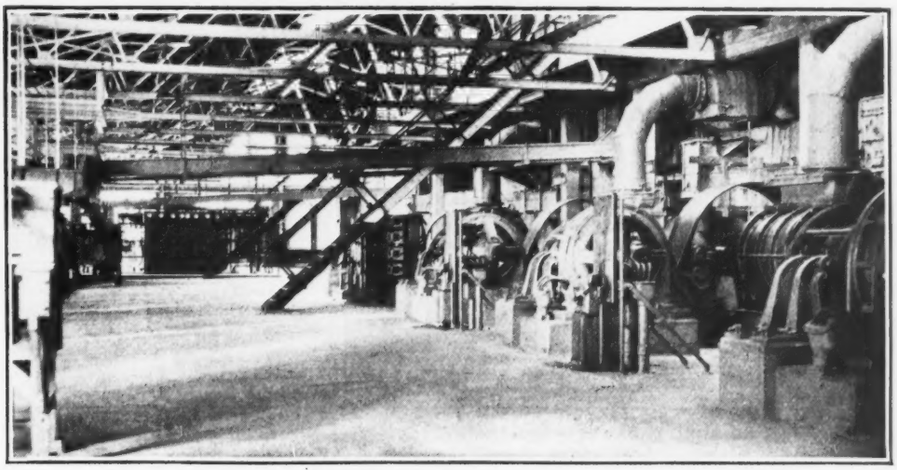
Fine-ore bins and incline conveyor



Primary Marcy rod mills

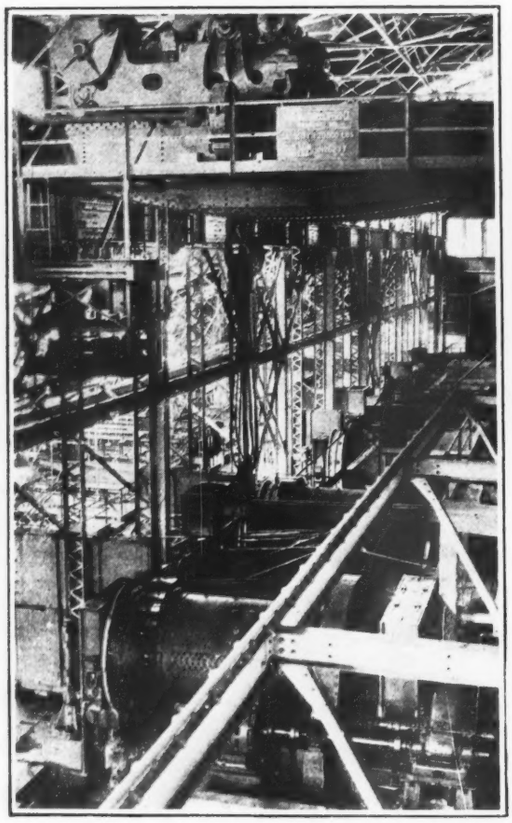


No. 8 McCully crusher

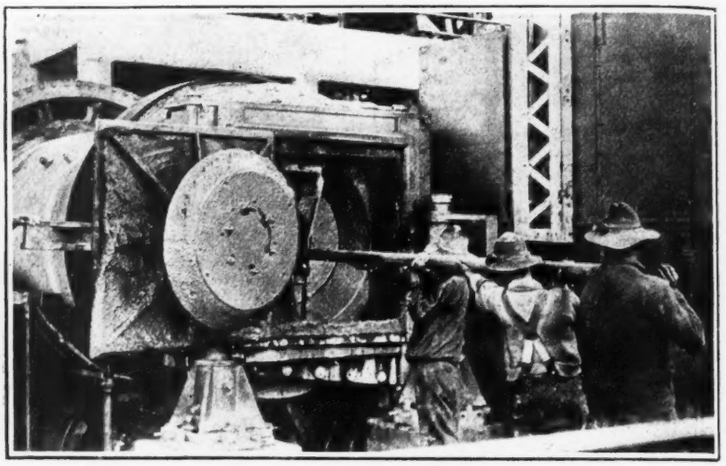


Blower floor (four No. 7 Roots) with transformer station in background

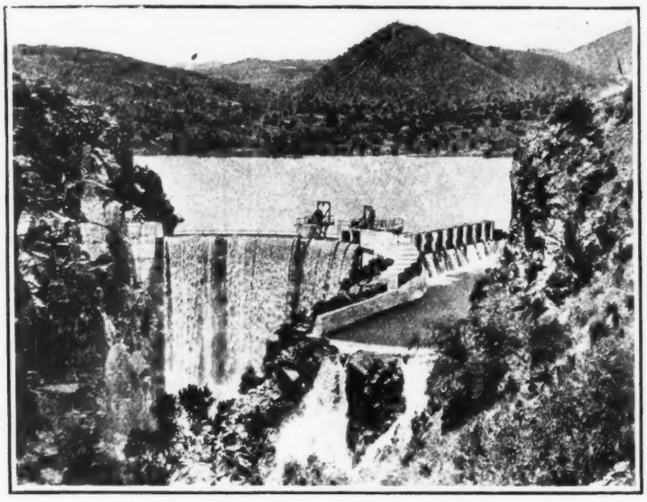
Equipment at Moctezuma Copper Co.'s Concentrator, Nacozari, Sonora



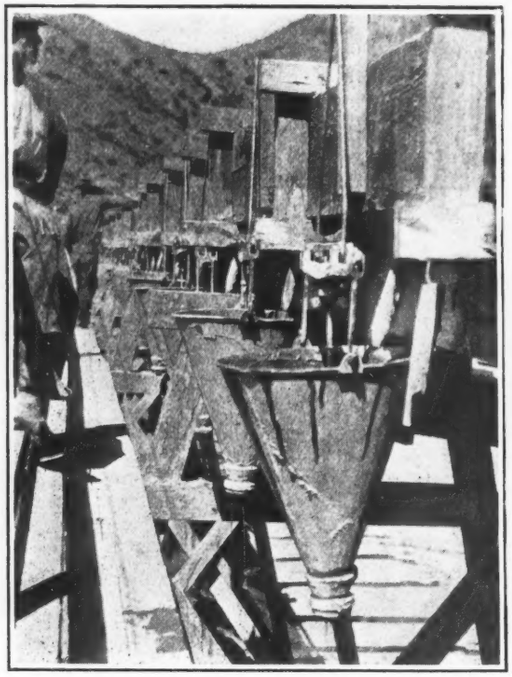
Secondary mill floor, with overhead crane



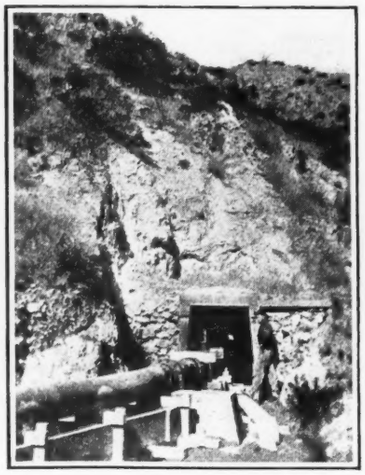
Rodding a Marcy mill



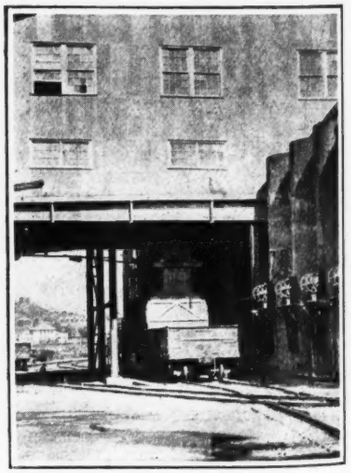
Huacal dam during rainy season



De-sanding cones at tailing dam at Nacozari



Tunnel, with main tailing launder and return water pipe



Loading concentrate on railroad cars for shipment to smelter

Discussion

An Open Gold Market

THE EDITOR:

Sir—The editorial in the July 5 issue of the *Mining Journal-Press*, "An Open Gold Market," questions the workability of the plan of charging industrial users of gold a higher price for such gold than can be obtained by exchange with the government, but does not offer a constructive suggestion as to how the gold miners can improve their economic position. British gold producers have benefited by the exchange differential existing between the gold dollar and the pound sterling, but no such relief is afforded the domestic producer of our own country.

What I propose is to prevent and prohibit the purchase of gold bullion from the Treasury for use in the arts. I know perfectly well that it will be a difficult problem, but all problems in business are difficult. I dare say that the proposition I have advanced (and it was originally instigated by me, I believe, a year and a half or two years ago), would be full of snags, but I do not know any business on the face of the earth that is not full of snags, that is worth the name of business.

Under present conditions, due to the war, the gold-mining industry is burdened with taxation to such an extent that it has added materially to the cost of operating, and with the standard price for gold, naturally these advanced expenses can only be met by mining a higher grade of ore, in many instances forcing the entire abandonment of valuable gold-mining properties. If the gold-mining industry could be relieved of the absurd taxation that it is now burdened with, it might not be necessary to give consideration to a premium on gold, but it is certain that the gold-mining industry needs relief, and we gold producers intend to find some method of obtaining that relief.

Would it not be wise to take up this matter from the constructive point of view, before our gold mines are completely destroyed? It is well enough to point out why a thing cannot be done, but I think it might be well for us to try to find out a way in which our business can be conducted. There may be some economic angle to this situation that I have overlooked; no doubt there is, but I do not believe in lying idle and simply stating that the gold standard should be maintained, or that we should not make an attempt to stimulate gold production, for fear the gold standard would be destroyed. I have no desire to destroy the gold standard, but I certainly desire to stimulate the production of gold and to receive for my labor what my labor is worth, and what my product is worth. The suggestions I have made will have no effect upon the gold standard.

I believe that no gold should be coined; that gold bullion should be maintained intact, if for no other reason than to reduce the loss by abrasion to a minimum. The annual loss by the use of gold coin in the United States is estimated at over one million dollars. This is an absurd loss. As a matter of fact, the use of paper money has become universally approved by our people, and so long as the paper money is backed up by a legal and sufficient amount of gold bullion in the Treasury of the United States, there is no logical reason why an endeavor should not be made to save for the government of the people over one million dollars annually.

If a jeweler can purchase from the United States Mint a bar of gold weighing 10 to 20 oz., and pay around $21 per ounce for it, then sell that gold to the trade for over $100 per ounce, it seems to me that the gold miner has been badly treated, as I believe that everybody who decorates himself with a gold ornament should pay the producer of gold for that privilege.

The plight of the gold producer is becoming very serious, and it would appear to me that we should view this serious situation with the same constructive assistance as is rendered the gold producer by the British Government within the British Empire.

San Francisco, Calif. W. J. LORING.

The Balanced Mill Is Defended

THE EDITOR:

Sir—Mr. Herman's article on the "Balancing of Crushing Machinery" in your issue of July 26 seems to me to be misleading. From his diagrams and logic your readers are assured that counterbalancing a crushing machine is not effective. The contrary can easily be proved in much less time than it took to write the article. One fact is worth a ton of theory, and many good things have been condemned because not properly understood.

Some time ago you described a simple method to show the power required to test out a ball mill by loading a drum and noting the different elevations to start it rolling down an incline. A tin can was used to represent the mill, marbles for the balls, and a board for the power. This corresponds closely enough to our larger mill operations to prove that balancing saves from 75 to 90 per cent in power, with several other features that are rather surprising. A 48-in. "balanced" mill using three tons of grinding bars was put in several years ago to help out a tube mill that required a 75-hp. motor. Three days after the "balanced" mill was put in it was doing *all* the work with 3 hp. This was not 200 per cent extraction; it was a mighty good saving in horsepower. The plant was dismantled a year ago, and the rods were so little worn that they were sent out with a new mill last spring, this after grinding probably 50,000 tons of silica sand at the old plant.

Two years ago two 48-in. mills carrying three tons of grinding bars were installed, using 3 hp. apiece, and have been turning out 70 tons a day, and the same rods are still in the mill and are good for several years to come. This mill is managed by an old-timer who regards all other kinds as back numbers. Another 48-in. mill with three tons of bars, using a scoop feed, uses 5 hp. (3 for the mill, 2 for the scoop feed), and grinds 1,000 lb. an hour to 300 mesh. It

looks good for several years so far as wear on rods and mill are concerned.

The first "balanced" mill, made ten years ago, went in in place of a 20-stamp mill. It ground a ton an hour of quartz. The owner always claimed two goats would run it, as the mill could be started without noticing that it made any difference on the 15-hp. motor that was running mill, crusher, elevator, mixer, and other machinery.

One can hardly put these facts in the divining-rod class, nor is any claim made to have discovered perpetual motion. I merely claim to have put a crushing machine in balance, the same as a car and cage balance each other in a mine shaft. P. C. FORRESTER.

Tacoma, Wash.

The Largest Nugget

THE EDITOR:

Sir—As a belated contribution to the discussion regarding the largest (and most valuable) nugget or lump of native metal ever mined, I would draw your attention to one lump which appears to be larger than any gold nugget that has been described, and which—in value at least—puts your "Keeley's prize nugget" completely in the shade. If you will refer to an official publication of the Geological Survey of New South Wales, "The Mineral Resources of New South Wales" (Sydney, 1901), you will find on page 29 et seq. an account of the "Holtermann nugget." This was a slab of gold taken out of a claim held by Messrs. Beyer and Holtermann at Hill End, N.S.W., in 1872. Its weight is given at 630 lb., its height at 4 ft. 9 in., its width at 2 ft. 2 in. and its thickness at 4 in. Its value was put down at £12,000, but this is only an approximation, since the slab was treated with a quantity of other stone; 400 tons of ore yielded 15,600 oz. of gold (valued at £60,000) for this particular crushing. It is claimed that this slab was the largest mass of gold ever taken out of a mine.

It is curious that this record "nugget" is so nearly forgotten, for Holtermann was not exactly reticent about his find. In fact, he had a woodcut made from a photograph, showing himself standing alongside the nugget, and broadcast it as widely as possible as an advertisement of patent medicines in which he was interested. B. G. PATTERSON.

Mount Morgan, Queensland, Australia.

Byproducts from the Bureau of Mines

THE EDITOR:

Sir—In the series of mimeograph "Reports of Investigations" that came to my desk today I found one on "Temperatures in Cabs of Freight Locomotives." I make haste to write you about this before your ready writer seizes on it as another horrible example of how a Washington bureau is attempting, like a certain paint company, to cover the earth.

The particular study here reported was one of four made at the request of railroads that had been having serious trouble with engine men being overcome by heat and gas in long tunnels. It did not seem unnatural, to me at least, that they should turn to mining men for experience in tunnel ventilation. The studies enabled us to make practical tests of several theories and of some devices that had grown out of our regular mine ventilation studies. So far as I know there was no other staff already having the especial experience necessary to the work. The railroads paid all the extra expense involved. The report has been prepared in mimeograph form, for internal use, making no draft on our extremely limited printing funds, but is available free to any technical journal that considers the results of sufficient interest to its readers to warrant republication. Finally, the studies were a real help to the railway men, since the remedial measures adopted have proved effective and no more men have been killed. Studies such as these are, to my way of thinking, valuable byproducts.

A few weeks ago you had occasion to comment on a little paper put out by this bureau having to do with marine boilers. An examination of the circumstances under which it was produced will, I think, be convincing that its justification is equally strong. You cannot be ignorant of the fact that fuel utilization has from the first been one of the major fields of study of the Bureau of Mines. Perhaps you know something of Kreisinger's classic studies and how they have entered into steam boiler practice. At Pittsburgh the Bureau has an unusual equipment and staff for this work, and it is one of its regular functions specifically provided for in the organic law and the appropriation acts to make tests and studies for the various branches of the government directed toward fuel economy. Sometimes the latter can be effected by change in choice of fuel, but more frequently alteration of the boiler setting or change in method of firing is equally effective.

At the beginning of the war the Shipping Board was called upon to provide a great fleet. The first thought was to fuel most of the ships with coal, and for many reasons economy of bunker space as well as fuel itself was important. The particular studies, the making of which you criticised, showed how, among other things, to make a ship go seven miles on the fuel previously adequate for only six. Such an increase in radius of action and decrease in bunker space would have been of great importance if the fleet had been equipped as first planned. It may still become one of the means of helping American shipping against competition.

I will confess to a certain impatience with a common assumption that every activity of the Federal Government should, in the interest of economy, be curtailed. As a taxpayer I have every sympathy with the effort to reduce expense, and I have been familiar with Washington too long to believe that it is necessarily a benefit "to make two desks grow where one grew before," but arguments for horizontal reduction applied rigorously to the constructive technical bureaus leave me cold in the face of organized raids on the Treasury boosting the Rivers and Harbors appropriation many millions above that allowed by the Budget Bureau and approved by the Appropriations Committee winter before last, and devoting other millions to bonus over the veto of the President last winter. Such raids would not be possible except through the pressure brought to bear by organized minorities and that of the very Chambers of Commerce who resolve in favor of government economy, but also for an appropriation for the local shipyard. Under these conditions it is more difficult than mining men generally appreciate to keep alive the research activities of the government. The whole pressure is toward starving research. For my own part I do not believe that is what the country wants.

Fundamentally, the American people do have a sense of proportion and a belief in common sense. If America is to face future world competition successfully, Amer-

ica's industries must be supported by broad fundamental research along the lines of safety and efficiency, and in any program for such studies the Federal Government must, for many reasons, do its share. In accomplishing the part that falls within the field of mining and metallurgy the Bureau of Mines needs all the help it can get. H. FOSTER BAIN.

Washington, D. C.

Gyratory Ball Action

THE EDITOR:

Sir—Recent comment and discussion with reference to the experimental use of various shaped grinding media is evidence of a healthy interest and desire for improvement in ball- and tube-mill practice.

The experimental work with cube-shaped grinding media which is being conducted by the Moctezuma Copper Co., at Nacozari, Mexico, has not been completed and we must patiently await publication of the information which will result from this large-scale tryout.

Because of the large amount of discussion brought about through this experiment it strikes me that millmen, metallurgists and operators might be interested in a comparatively new development in ball-mill practice which is possibly more fundamental than the development of a new grinding media, and which has already passed through the experimental stage.

The development referred to is the Williamson ball mill, one of which, after considerable data had been secured concerning its performance, was installed and is operating in a plant which was designed and constructed by myself.

This mill differs from the commonly used types of ball mill in that the ends are of peculiar design, giving a new shape to the interior of the drum. The accompanying kodak pictures show propeller-like or intrusive false heads, which have been permanently installed on the feed and discharge heads of a ball-mill shell. Liner and discharge grates fit on top of the false heads and are replaceable the same as in any mill.

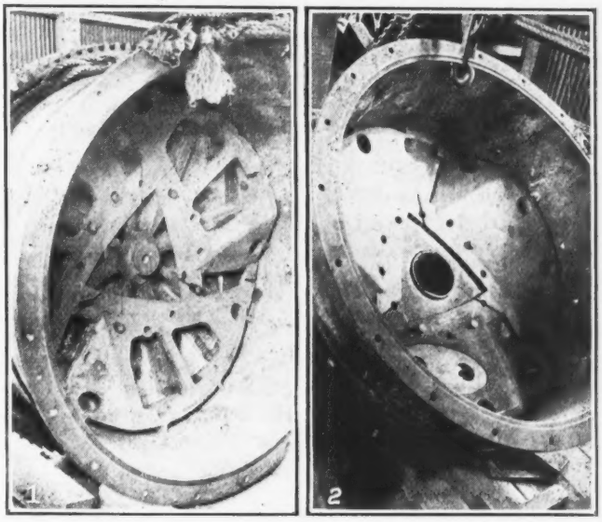
The full effective diameter of the mill, through which the ball charge acts, is not reduced to any appreciable extent by these propeller-like intrusions which function to displace and eliminate from the ball charge those balls normally at and near the ends of a mill which consume considerable excess power in comparison to the grinding work they do.

In operation, the intrusions apparently produce a very substantial increase in the ball and grinding action of the remaining portion of the ball charge. The balls flow downward from the ends toward the center of the mill and also from the center toward the ends, which action produces an additional movement of the balls longitudinally in the mill from and toward the ends.

The results seem to be that, in addition to increasing the ball action and producing a gyratory movement of the flowing balls, a uniform admixture of the different sized balls also occurs. This is unlike the action in other mills in which there is a tendency for the balls to flow in more or less established paths and to group themselves more or less according to size. The continuous interference with the establishment of definite paths of ball travel is in reality a mixing action which operates to distribute the pulp thoroughly throughout the ball mass, and which creates in the ball charge itself a greater number of voids of smaller individual size, all of which makes for more thorough distribution of the pulp and subjects it to more ball contacts.

This brief description does not go into such details as absence of slippage on the shell, uniform wear of liners, increased discharge, etc., but covers the principal points which seem to account for the improved results obtained in actual practice.

As stated above, the mill has passed through the experimental stage and has been successfully operated in installations where excellent operating data are matters of record; and according to my own experience has shown a definite saving of 30 per cent in power input and a saving of 15 per cent in ball consumption by direct comparison and thorough tests in parallel with



1. Skeleton head in place in feed end of mill shell. This changes shape of interior of shell. Liners fit on top of skeleton head. 2. Liner fits on false or skeleton head and is bolted through it to the shell

units operating under normal and well-known conditions. W. A. LINFESTY.

San Bernardino, Calif.

Lead Now in the Sporting Class

THE EDITOR:

Sir—Lead in a market sense is so rapidly getting out of the class of plain, useful, workaday metals and into the sporting class with tin and quicksilver that it seems to me that, granting this to be an undesirable change, the trade press (and federal reports and press bulletins as well) should give fuller publicity to the facts of lead production, importation, and consumption and devote less space to broadcasting rumors of "scarcities," "shortages," "famines," and "wasting reserves."

The statement in your issue of Aug. 9 that the St. Joseph Lead Co. is producing 13,000 tons of lead monthly is by way of being a valuable counter-irritant, alterative, and corrective, as indicating an increased production by the southeast Missouri disseminated-lead district in 1924. The Joplin district to date reports an increased output of lead over the production of 1923, and the Western states 1924 midyear statments indicate activity in lead mining. All this should be reassuring to the producer and consumer, and disconcerting to no one whatever except to the metal sporting fraternity. C. E. SIEBENTHAL.

Washington, D. C.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

A LARGE PROGRAM of shaft sinking at various mines on the Gogebic range in Michigan is the most important activity of the Oliver Iron Mining Co. in that district.

The exploration of the Cliff and Tecumseh lands has been started by the Calumet & Hecla company in the Michigan copper country.

The Lake Shore Mines Co. during the first fifteen days of September milled 244 tons of $17.76 ore daily in its enlarged plant.

Co-operating with the Federal Bureau of Mines, the Arizona Bureau of Mines will make a survey of complex sulphide ores in southern Arizona preliminary to undertaking metallurgical research.

Dividends have just been declared by the Silver King Coalition, Park City Mining & Smelting, and Tintic Standard companies of Utah.

New shafts have been started by the Tonopah Keystone and MacNamara mining companies in the western part of the Tonopah, Nev., district.

A recently completed customs ore-sampling plant at Kingman, Ariz., is expected to assist gold miners in the vicinity.

Various districts outside the Coeur d'Alene are contributing much to the mine activity of Idaho.

Finding of high-grade ore on the 2,000 level of the Main Range mine at Butte is reported by the Tuolumne Copper Co.

Will Survey Southern Arizona for Complex Sulphide Ores

Step Preliminary to Investigation of Treatment Problems—Mining Bureaus to Co-operate

Claims are continually being made to the effect that large quantities of lead-zinc-copper ores that carry more or less silver and gold are available in southern Arizona. It is said that all that is needed for a great revival of the mining industry in that part of the country is the discovery of a cheap process for treating such ores.

Until recently there seemed to be little hope that the problem could be solved for a good many years, but later developments in metallurgy and ore dressing, especially in flotation and electrometallurgy, encouraged metallurgists to believe that a method of treating these ores successfully may be found.

Before the U. S. Bureau of Mines experiment station will investigate the problem, it must be shown that a sufficient tonnage of these ores is available to warrant making a protracted and extensive series of experiments. It must further be shown that ores from many different properties and camps are sufficiently alike in physical properties, so that any process that will work successfully upon one ore can also be used on many others.

The Arizona Bureau of Mines, under the direction of G. M. Butler, will co-operate with the U. S. Bureau of Mines, by making a preliminary investigation of the tonnage and character of such ores in the vicinity of Tucson, and later may extend this work to cover the entire state.

No attempt will be made at this time to work out a method of treatment for oxides, carbonates, and silicates, or for such ores when mixed with sulphides, the investigation being confined solely to sulphide ores.

Tariff Commission Ordered to Make Copper Tariff Survey

THE Tariff Commission, at the request of Michigan Senators, was directed on Sept. 24 to make a survey of the copper situation for the purpose of determining the need of tariff protection for copper. The Commission will begin its work immediately, but a full report is not expected for many months. Agitation for a tariff has been most noticeable in northern Michigan.

Alaska Juneau Made Operating Profit in August

Alaska Juneau, in Alaska, averaged over 8,000 tons per day during August, 1924. The total mined and trammed was 258,500 tons. The recovery was $157,200, or 60.81c. per ton. Costs were 48.82c. per ton, leaving an operating profit of $31,000, or about 12c. per ton. Expenditures on capital account were $23,500; on Ebner mining property, $1,500; and interest on indebtedness was $15,800; a total of $40,800. This left a deficit of $9,800 for August.

Tuolumne Copper Co.'s New Strike Promising

High-grade Orebody on East Side of Continental Fault—May Help North Butte Company

High-grade primary copper ore, consisting principally of bornite and enargite, has been struck on the 2,000 level of the Main Range mine at Butte, Mont., owned by the Tuolumne Copper Co. According to Paul A. Gow, general manager, the ore, the extent of which has not yet been determined, occurs in a blind vein on the east side of one of the large strands of the Continental fault. This part of the Main Range mine has not hitherto been prospected. The character of the ore and its occurrence east of a part of the Continental fault make this strike one of major importance and should lead to the development of high-grade copper orebodies not only in the Tuolumne properties but in the east side properties of the North Butte company as well. The Main Range mine has produced about $1,250,000 gross from secondary ores on the upper levels from a limited area.

The Rory O'More vein, in which high-grade ore is being developed in the East Butte property to the southwest of the Main Range mine, has not yet been cut. Neither has the Spread Delight vein been developed to the east.

Plans have been completed for sinking the Main Range shaft from the 2,200 level to the 2,800 level, and lateral working will be extended on the 2,400 and 2,800 levels fully to develop the property.

Much Shaft Sinking in Iron Mines of Gogebic Range

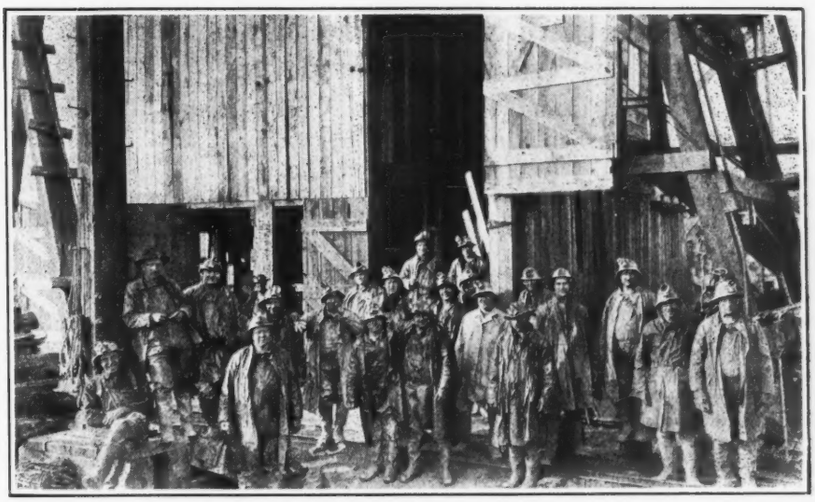
Newport Will Clean Up Stockpile—Yale Mine Shut Down for Three Years

Deepening of the shafts at its mines on the Gogebic range, in Michigan, is an important activity of the Oliver Iron Mining Co., a subsidiary of the U. S. Steel Corporation. At several mines near Ironwood the company has been putting ore on stockpiles instead of shipping it. For the last two months only certain grades have been shipped. The mines are however, working full time and employing about the usual number of men. Quite a number of them are employed in exploratory and development work.

At the Geneva mine a large new shaft is being sunk, which is now past 1,550 ft. in depth. Sinking of "G" shaft of the Pabst mine from the 24th to the 27th levels is nearly completed, as is the deepening of No. 1 Puritan shaft about 600 ft. Deepening the "A" shaft at the Norrie mine 500 ft. is still in progress, and at the Davis mine preparations are being made to sink No. 1 shaft an additional 400 ft. below the 26th level.

It is reported from a trustworthy source that the Newport mine of the Youngstown Sheet & Tube Co., at Ironwood, will ship all the ore now in stock at the mine. The mine has been working one shift four days per week this summer, and even at that rate would find difficulty in getting stockpile room this winter if the old piles were not shipped. Until now shipping from stock has been intermittent and at a low rate.

The Yale mine, at Bessemer, belonging to the Charcoal Iron Co. of America, has been closed down completely. The pumps have been pulled and all other underground equipment has been removed, and the splendid surface plant (only five or six years old) is boarded up. All the men, even to the mining captain, Harry Olds, and the superintendent, W. E. McRandle, have been laid off. Oglebay, Norton & Co. is handling the sale of the stockpiles. The ore reserves are believed to be almost exhausted; only about 600,000 tons of ore remains underground, most of which is of a sticky grade which is hard to market. Local officials predict that the mine will not be reopened for at least three years.

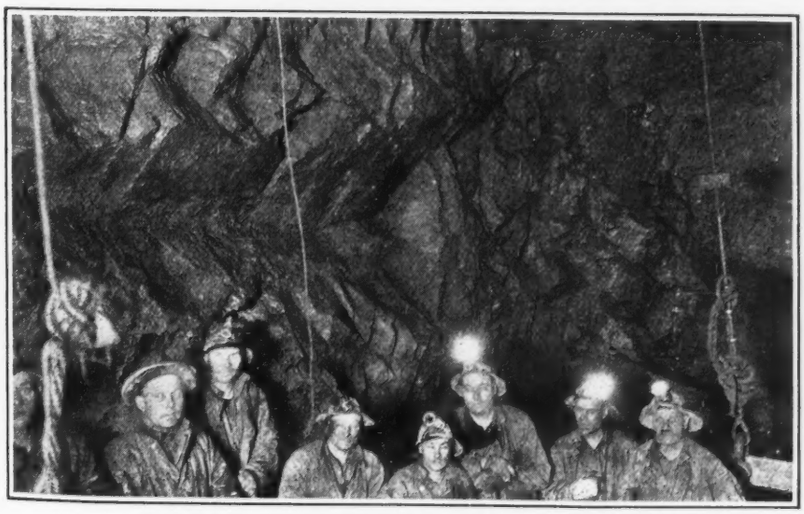


Shaft-sinking crew at the new Geneva shaft of the Oliver Iron Mining Co., on the Gogebic range in Michigan

Gold Dome of Gold Circle, Will Be Reworked

The Gold Dome Mines Co. is about to start underground work on its Eastern Star mine, in the Gold Circle district in Nevada. Surface equipment is in place, the shaft has been repaired or retimbered to the tunnel, or 75 ft. level, and the small pumping machinery has been overhauled.

The mine is an old one, with a rather spotted career. The vein is developed to a depth of 260 ft. The main levels are the 75, or tunnel level, the 160 level, and the 260 level. Little work, except shaft sinking, was accomplished below the 160 level, partly because of the inflow of water. There is estimated to be $100,000 worth of ore of mill grade now available in the mine.



New Geneva shaft—one-third mile underground

The Oliver Iron Mining Co. has reached 1,550 ft. in sinking this new shaft near Ironwood, Mich.

Working Shaft at Leola Mine Will Be Sunk

Once Produced $7,000,000 by "Chicken-ladder" Methods—A. S. & R. Co. Inspects Magdalena

The Kansas City-Tulsa interests owning the Leola mine, in the Totolapam district in Oaxaca, Mexico, have completed their prospect shaft to about 700 ft. They find the vein in place below the old workings and will now proceed to sink the working shaft, according to the report of the manager. This mine, formerly owned by the Rickard family, early English pioneers in this section, has a known production of about $7,000,000, entirely taken out by the "buscon" and "chicken-ladder" methods. This was before the days of railroads, and all of the ore was packed on mules to Vera Cruz, from there being shipped to Swansea for treatment. With the pack trains it took thirty days to make the round trip to the port. Long abandonment caused the old workings to cave, and the only means by which the new company could safely conduct operations was to sink the shaft above mentioned.

An official of the A. S. & R. Co. recently made an inspection of the Magdalena lead properties south of Tlalcolula. The mine is conceded to be a very rich one, but has entirely caved, and the plant is in a dilapidated condition. The state authorities are constructing a road from the Oaxaca-Tlalcolula automobile road in the direction of this property. This should add materially to the attractiveness of the venture.

Tonopah Hasbrouck Ships

As an indication that the Tonopah Divide district in Nevada is still on the map, comes the announcement of a recent shipment of siliceous ore by the Tonopah Hasbrouck Mining Co. This ore was mined from a new vein west from the lower tunnel and will run about $15 per ton. The smelting company has granted a favorable rate on ore of this particular character, which makes it possible to ship this grade at a profit.

Three Utah Silver-Lead Mines Declare Quarterly Dividends

Tintic Standard Leads With 25c. Per Share—Nearly $1,000,000 to Stockholders in Nine Months—Park City M. &. S. Starts Mill on Two-Shift Basis

THE following dividends, recently declared, indicate the prosperity of silver-lead mines in Utah: The Tintic Standard Mining Co. declared its regular quarterly dividend of 10c., in addition to an extra dividend of 15c. per share; the Silver King Coalition and Park City Mining & Smelting, both operating at Park City, ordered disbursements of 15c. per share each. By a coincidence, all three announcements were made on the same day.

On Sept. 29, when checks amounting to $287,185 are sent out to Tintic Standard stockholders, the company will have paid during the first nine months of this year $917,920. The company's grand total of dividends will then aggregate $3,331,737.

The physical condition of the mine as well as the financial status of the company are remarkable. The company has a cash and bond surplus exceeding $2,600,000.

In addition to this available balance, there are in transit sixty carloads of ore having a value of approximately $150,000. A report for the first six months of the year is being prepared by the company to be mailed with dividend checks to stockholders. Production of the company is averaging from 13,000 to 14,000 tons of ore a month. Silver King Coalition company's fourth quarterly dividend during the year, amounting to $182,415, will bring payments to stockholders for 1924 up to $729,660, and company's grand total of dividends to $17,326,756.

The Park City Mining & Smelting dividend brings the total for the year to $525,600, and the total to date to $13,022,400. This company reports the stope above the 900 level to have been opened another 600 ft. in the last six months, with the ore continuous.

In places the orebody is from 50 to 70 ft. wide, and the thickness ranges from 6 to 20 ft. The mill—which, during the quarter just ended, has been working one shift—will now, since the rise in the price of lead, run two shifts.

Cash and bond balances are in excess of $900,000. Ore in stock and other credit items bring the total available balance to $1,000,000.

In all, Utah silver-lead mines will pay, on or before Oct. 1, a total of 55c. a share, or $701,000 to stockholders.

Will Rework Old Kittimack Dump Near Silverton

A. M. Allen and George H. Bibb, of Silverton, Colo., have secured a long-time lease on the old tailings dump of the Kittimack mill, and will install a plant for fine grinding and selective flotation. Surveys and tests are being made to determine whether the old plant will be utilized or a new and more convenient location selected. The mill was operated about fifteen years ago, treating ore from the Clark stope of the Kittimack mine, and it is believed that the lack of proper equipment, coupled with bad management, resulted in heavy loss in treatment.

Remnants Mining Co. Seeks Remnant of Zinc Ore

The Remnants Mining Co. has been organized to take over the Quebec and Montreal leases, in the southern part of the Picher district in Oklahoma. Principals in the company are Victor Rakowsky, mining engineer; Foster Naething, geologist; George Spiva, powder manufacturer and capitalist; and Jesse G. Starr, banker and zinc smelter.

The Montreal was one of the first rich mines to be developed in the Oklahoma section of the field, and the lease undoubtedly is well cut out. The Quebec lease, alongside, also has been worked by two different companies, but parts of its acreage have not been drilled thoroughly. The Remnants company will operate the mill still on the Quebec lease if underground development justifies.

Lower Royalty Rates for Tungsten Lessees in Colorado

The Wolf Tongue Mining Co., chief producer in the Nederland tungsten district in Boulder County, Colo., announces a reduction in royalty demanded of leasers, from 25 per cent to 15 per cent, effective at once. "We are doing this to encourage the leasers on our property and in an effort to get men to develop claims that are now idle," said Wm. Loach, manager. "The royalty has always been 25 per cent. The ten per cent reduction should make it possible for the men to make more than a $4.50 wage, which they have been averaging from their lease operations on our property."

Mr. Loach stated that there was little demand for tungsten and that the Wolf Tongue company could only market its product by virtue of its Firth-Stirling affiliation. The company will continue to pay on the unit basis of $10, which is the market.

Calumet & Hecla Starts Work On New Substation

Calumet & Hecla Consolidated, in the Michigan copper district, is giving much attention to its pumping problem in the conglomerate department, and by next spring it is expected the project now in hand will be well on toward completion. In No. 5 Tamarack shaft, which will be the main pump shaft, powerful electric pumps will be installed. For this purpose one station has been cut at the 24th level and another ultimately will be established at the 46th.

Tonopah Boom Is Substantial If Not Sensational

Two Companies Start Shaft Sinking—Good Chance for Important Discoveries—Capital Needed

Interest in development in the western part of the Tonopah district, in Nevada, is increasing. Two companies have purchased ground adjacent to the West End Extension property and have started shaft sinking. The MacNamara Mining Co. has purchased two claims which join the MacNamara Crescent on the north and the West End and the West End Extension on the west, and a shaft is to be sunk near the dividing line between the MacNamara and the MacNamara Crescent. These companies are closely related and will share the expense. The Crescent has an excellent surface equipment at its 1,200-ft. shaft, including a double-drum hoist and compressor plant, and this is to be moved to the site of the new shaft, 4,000 ft. west and north of the old one.

The shaft of the Tonopah Keystone Mining Co., which owns ground to the west and adjoining the property of the West End Extension, is already down 30 ft. and surface machinery is being placed.

Claims have been located for a distance of six miles to the west of the West End Extension ground, and transfers are being made daily. One group of approximately 160 claims has been optioned from various owners, and is soon to be offered to eastern capitalists for consideration. To the north the recent developments by the Tonopah Extension from its 1,760 level, several thousand feet to the north of the main vein system, has led to claim activity in that direction.

Generally speaking, conditions are better than for some time. New work is being started in virgin territory, with excellent chances for important discoveries.

Much Doing in Quebec Asbestos Mining Industry

Fire at the property of the Consolidated Asbestos Mines, at Thetford Mines, Que., destroyed the cobbing plant on Sept. 17. The damage was estimated at $15,000. The week previous a small tornado damaged the mill and equipment of the Asbestos Corporation to the extent of $50,000 to $60,000. These two companies are the largest producers in the district. A slide in the pit of the Quebec Asbestos Corporation occurred last week, affecting productive operations.

Asbestos Mines, Ltd., expects to resume operations at an early date. The Maple Leaf Asbestos Corporation is running to capacity and having difficulty keeping up with its contracts. The new plant is operating smoothly and giving entire satisfaction.

The Quebec Trust Co. has purchased the Bennett-Martin Asbestos Co., which recently went into the hands of the receivers. The name of the principal for whom the trust company acted has not been announced. Some improvement in the market for sundry mine products has encouraged operators and producers.

Old Tintic Mine Dumps Find Way to Smelters

Dump ore is being marketed from a number of properties in the Tintic district in Utah, in accordance with the object of the recent sale of the Mammoth dump to one of the large smelting companies operating in Salt Lake valley. The Uncle Sam—now consolidated with the May Day to form the Mountain View—is furnishing ore from the dump at the Humbug workings, where about 2,000 tons is accumulated. The dump ore is being shipped from the Sioux Consolidated, and it is reported that arrangements are being made to place similar material from the Little Spy, of the Empire Mines Co., on the market.

The Tintic Milling Co. has also been shipping dump ore regularly, for some time. A shortage of this class of ore at the melting plants results in a favorable price.

Hewer Mine, New Producer, Finds Parallel Vein

From a forgotten prospect on which a few feet of tunnel had been driven many years ago, until it attracted the attention of Dan Drumheller, Jr., two years ago, the Hewer mine, near Lakeview, Idaho, is now operating on a three-shift basis, milling 100 tons of silver-lead ore per day. About thirty men are employed, and a two years' supply of ore in sight indicates with what rapidity a mine may spring into existence.

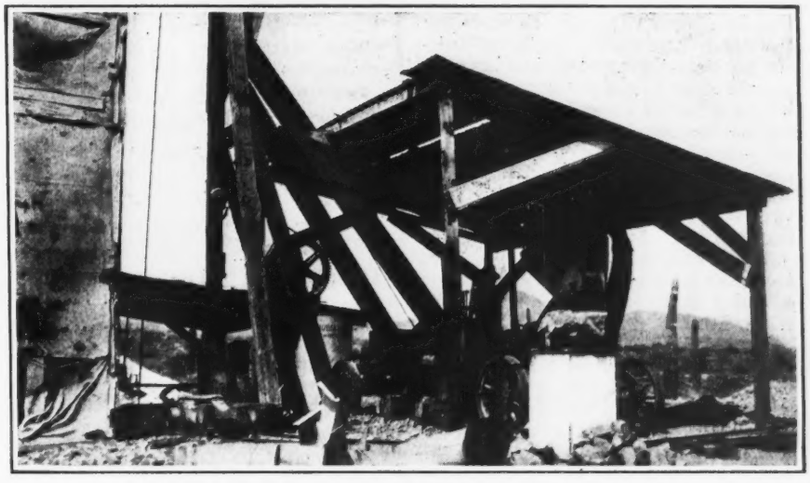
In April of this year the company was satisfied that the tonnage of ore blocked out warranted the erection of a concentrating plant. In August the plant was in operation, and concentrates were piling up in the bins.

A recent strike in the mine of a new vein paralleling the main orebody will add to the reserves. The mill is operating with well over 75 per cent recovery, which can be raised to 90 per cent as soon as final adjustments are made, according to Mr. Drumheller. A boarding house to accommodate seventy men is nearing completion, and other buildings are in the process of erection.

Discarded Automobiles Furnish Power for Sinking Mine Shaft

Buick Engine Converted to Serve as Compressor—Run by Pierce-Arrow Motor—Michigan Engine Runs Hoist—130-Ft. Shaft; 75-Ft. Crosscut

AN INSTALLATION composed of four discarded automobiles is being used to prospect what is believed to be a continuation of the old Vulture vein, in the Wickenburg district, in Arizona. A two-compartment shaft has been sunk to a depth of approximately 130 ft., and a crosscut on the 100 level has been driven 75 ft. This work, including the installation of the equipment, has been accomplished by two men within four months.



Novel and economical hoist

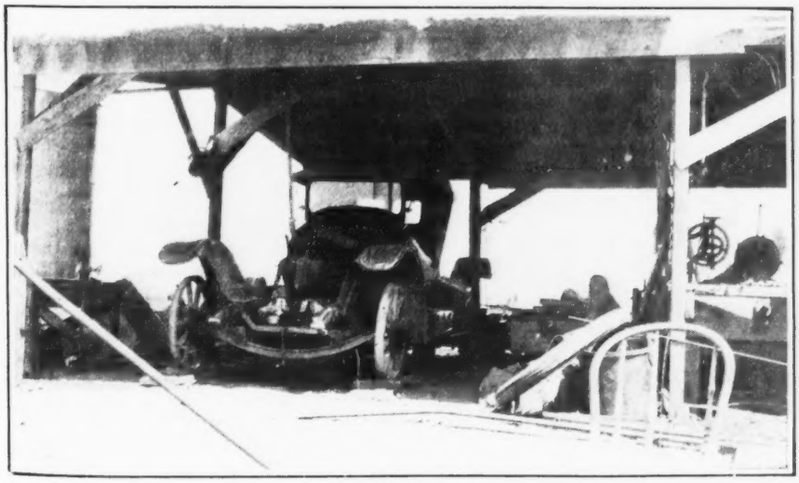
One advantage of this hoisting engine is that it was taken to the mine on its own wheels and under its own power

The hoist is operated by an old Michigan motor, with the transmission gears to the rear wheels removed and the drive shaft connected directly to the drum. The main drive shaft was also continued beyond the rear wheels, so as to allow ample space in operating the hoist.

Each time a car of ore is to be hoisted, the engineer cranks his motor, and hoists about 200 lb. of rock. Compressed air is furnished by means of three old automobiles, one of which, a Pierce-Arrow, is used to drive the main shaft, which is connected to two old Buick motors, with valves reversed, which makes compressors out of them. Only one is used at a time, the other being kept as a spare. This furnishes sufficient air to operate one Jackhamer, with which a 5-ft. round is drilled in a shift. Air pressure is 90 lb. When the drilling machine is to be operated underground, the Pierce-Arrow motor is started.

O. W. Blickenstoff, the prospector who is sinking this shaft, is already down 130 ft. and believes it possible to go considerably more than 500 ft. with this equipment. All four automobiles were purchased for a few hundred dollars apiece, and the entire installation was made for about $1,000. This ingenious assembly is not an experiment, as Mr. Blickenstoff has previously sunk other prospect shafts with similar equipment.

The installation is 16 miles from a railroad, and the old automobiles were therefore driven out this distance from the railroad station, before being set up.



Pierce-Arrow-Buick compressor

Two discarded machines make unit capable of supplying 90-lb. air for rock drilling

Moore Mining Co. Made Small Profit in August

The Moore Mining Co., of Jackson, Calif., milled 2,072 tons of ore in August, 1924, making a gross production of $12,892. The ore averaged $8.40 and recovery was $6.70 per ton. Operating costs, not including development, totaled $10,501, leaving a gross operating profit of $3,390.

In shaft sinking the oreshoot encountered on upper levels was intersected at 1,060 ft. The shaft has reached a depth of 1,105 ft. and will be extended to 1,160 ft. in depth.

Idaho Activity Not Confined to the Coeur d'Alene

New Orebody in the State Continental —Cynide Gold Finishes Power Plant; Will Start Mill

Although the Coeur d'Alene region is the most active district of Idaho, the rest of the state is not idle, and several worthy properties have been made to yield well. A strike of great importance has recently been made in the Idaho Continental near Porthill, in which a new orebody has been opened. It is 8 ft. wide, and has been followed to date 325 ft. The new orebody will add several years to the life of the mine, which has been a constant producer of lead-silver ore for twelve years.

In the same district near Bonners Ferry the Cynide Gold Mining Co. has completed the erection of a dam and hydro-electric plant and built an 11 mile transmission line to the mine. The operation cost about $130,000. At a cost of $40,000, additions to the mill in machinery equipment will be installed before production will start.

In Valley County, the Bunker Hill & Sullivan Mining & Concentrating Co. has acquired the Lost Pilgrim property. Here it is completing a water-power project which will furnish 200 hp. to explore a vein 50 ft. wide carrying lead-silver milling ore. This is said to be one of the most promising prospects in the state.

Near Grangeville, in Idaho County, the Submarine Gold, Placer & Quartz Mining Co. will start its dredge on Sand Creek flat near the old town of Florence. A steam shovel is busy digging a ditch to drain Gold Lake and the meadow that the company intends to work. The property has been leased from resident miners, who have long tried to reach the rich pay at the bottom of the lake. In the same district Tom Myer and Frank Laib claim to have located the Secret mine, which yielded a fortune to Luck Piper.

Near Clarksford, in Kootenai County, the Lawrence Mining & Milling Co. has disclosed a lead-silver vein 6 ft. wide. The company has produced about $65,000 worth of ore. The new strike is largely milling ore, according to reports from the mine.

At Lakeview, the Hewer Mining Co. is starting its new 100-ton flotation plant, built to treat lead-silver ore.

Bridget Sullivan Gets Judgment Against Maricopa Copper Co.

The Maricopa Consolidated Copper Co. has filed an appeal against a judgment of the Maricopa County Superior Court, in the amount of $17,000, in favor of Bridget Sullivan, widow of Eugene Sullivan, a former employee of the company, who it is stated died as the result of injuries sustained when he was caught in a flywheel of a gas engine and thrown into other mining machinery, while in the employ of the company.

The property of the Maricopa Copper Co. is about 17 miles northeast of Ajo, where the New Cornelia Copper Co. operates in Arizona.

Young Engineer Smothered in Bin of Crushed Ore

A PECULIAR and gruesome accident at the milling plant of the Utah Apex Mining Co., of Bingham, Utah, resulted in the death, on Sept. 23, of Joseph Ira Barker, a young mining engineer, newly employed at the plant. The body was found in a pile of crushed ore in a bin into which the victim must have fallen through a comparatively small opening in the iron grating cover. Death must have resulted through suffocation. Other workers within a few feet of Barker knew nothing of the occurrence, until the feed to one of the ball mills choked, and a pair of human feet were found protruding from the mouth of the chute. Officials of the company are making an investigation.

Phelps Dodge Orders Survey of 216 Mill Sites

Orders for the survey of 216 mill sites, comprising an area of 1,020 acres, will soon be issued by C. M. Donohoe, United States Surveyor General of Arizona. The surveys will be made for patent at the request of the Morenci Branch of the Phelps Dodge Corporation. According to Mr. Donahue, this is the largest survey ever requested of the Survey or General in the State of Arizona.

United Verde Prospects Under Venture Claims at Jerome

As a result of the recent development by the Verde Central, at Jerome, Ariz., the United Verde Copper Co. is driving a drift under a group of claims known as the Ventures. The drift has been started from an old tunnel on the Calumet & Jerome property, and is now 80 ft. beyond the Venture line at a greater depth than those claims have ever been opened. The face is in greenstone schist, heavily mineralized with pyrite and a little copper.

Preparations are being made at the United Verde for the big blast which will loosen about 200,000 yd. of material near the old No. 2 shaft on the 160 level. A tunnel is being run into the mountain side to the west from the big shovel cut on the 160, and it is expected that about a month will be required to complete the work. It will be loaded with approximately 100,000 lb. of dynamite, and the result will be the loosening of more than 200,000 yd. of rock, to be handled by steam shovel.

Mammoth Repairs Fire Damage

Forest fires recently destroyed an angle station on the wire-rope tramway at the Balaklala mine property and interfered with shipments from the Keystone mine to the Mammoth smelter at Kennett, Calif. Repairs have been made and shipments from the Keystone are soon to be resumed.

Calumet & Hecla Will Explore Cliff and Tecumseh Lands

Outcome of General Geological Survey —Osceola Shaft Likely To Be Used—Repairs Necessary

Two important exploration projects will soon be undertaken by Calumet & Hecla Consolidated, in the Michigan copper district. One will be in the old Cliff lands and the other in the old Tecumseh lands of the La Salle Copper Co., now a part of the Consolidated company.

In the Cliff lands, a survey has been completed, and the Osceola lode will be opened and investigated either by an adit or a shaft. It is probable that a shaft will be sunk 200 ft. and the formation opened by drifts. The proposed work will be done at a point approximately 1,000 ft. south of the old Cliff fissure-vein shafts. It is the only stretch in the old Cliff lands which has not been thoroughly explored. It has been established that little copper exists in the Kearsarge formation in this area, but the Osceola lode offers possibilities.

In the Tecumseh lands, in which two shafts were sunk in the '80s, one on the Calumet conglomerate 1,000 ft. deep and the other on the Osceola vein, 2,300 ft. deep, exploratory work will be carried on through one of the existing shafts. From it drifts will be driven to investigate the formation. It is believed the shaft on the Osceola lode will be the one reopened, inasmuch as the southern drifts of No. 6 shaft of the Osceola mine, below the 4,000 level, near the Tecumseh boundary, are among the best in that property. Reopening of the shaft will necessitate considerable preliminary work, particularly in pumping out the workings and repairing the timbers, which have deteriorated considerably.

Decision of Calumet & Hecla Consolidated to conduct these two explorations is based on the extensive geological survey recently completed. Other recommended projects will be undertaken in due course. There is no assurance that commercial copper values will be found, but the ground to be tapped is the most promising.

Kingman District Will Have an Ore-Sampling Plant

The new sampling plant at Kingman, Ariz., which is expected to be complete and in operating condition soon, will prove a real boon to the prospectors and operators of small mines in Mohave County. It is said that, with the opening of this sampling plant, many small mines in the district, both north and south of Kingman, will be able to have their ore tested before sending it to smelters in other parts of the state. Such service should afford the small prospectors and miners an opportunity of saving considerable money.

Ores mined in this district are now being shipped to Clarkdale and Humboldt, in Arizona, and to El Paso, Tex., and Selby, Calif., The new plant, according to report, will be operated by F. W. Manson, who now conducts a sampling plant in Nevada.

Washington News

By Paul Wooton

Special Correspondent

Quicksilver Tariff Helps Domestic Industry Little

Only One-third of Supply Comes From Home Mines—Consumers Pay 25c. per Pound on Imports

Despite the stimulus of a tariff of 25c. per pound on quicksilver, the domestic industry, in the opinion of competent observers, is not establishing itself on a substantial basis. Less than one-third of the country's requirements for this essential metal is being supplied from domestic sources. In 1923, it was necessary for the American public to pay an additional 25c. per pound on the 1,568,551 lb. imported. Disinterested opinion is to the effect that the principal result of the duty has been to permit further depletion of American mines and the loss of reserves which would be of incalculable value were the country involved in a war which would render impossible the maintenance of communication with Spain and Italy. In this connection, it is significant that, despite determined efforts under the pressure of great necessity, no substitute for mercury as a fulminating material was developed during the war.

Though the peace-time uses of quicksilver do not fall in the same vital category as do its war-time uses, it nevertheless is an essential commodity. About one-half of our consumption goes into medicinals. There still is a substantial demand for it in connection with the recovery of gold and silver from their ores. It is being used in increasing quantities as a constituent in non-fouling paints. A substantial aggregate is used in the hat and fur industry and in the manufacture of mirrors, thermometers, and barometers and other technical instruments.

A further indication that it is folly to attempt to build up a domestic industry under present conditions is held to be the fact that American ores run only 0.5 per cent quicksilver, whereas those mined in Europe are from two to eight times richer.

April Fool Mining Co., Among Others, Gets Relief

Six awards, totaling $44,417, covering war mineral relief claims, have been recommended by the War Minerals Relief Commission. The largest was to the Valley Forge Mining Co. of Bristol, Tenn., the amount being $17,272. Final settlement of the claims will not be made by the government until the claimants accept the awards. The names of the claimants with the amounts by states follow:

California	
J. A. Faucher, Oakland	$2,927
Colorado	
John Bensen, Nederland	$924
John L. Stone, Boulder	$7,659
April Fool Mining Co., Boulder	$14,238
Tennessee	
Valley Forge Mining Co., Bristol	$17,272
Webb & Galbraith, Knoxville	$1,396

Would Have Study of Underground Haulage Accidents

Complaint frequently is made that haulage accidents in mines are inexcusably high. It is true that next to falls of rock and roof come accidents incident to underground transportation; but the fact that half of the tonnage carried by the railroads of the United States must first be transported underground, in the dark and for the most part over temporary roadbeds, is frequently ignored. Underground hauls of 5 miles are not uncommon. To secure the economies of quantity production, this haulage must be done at high speeds.

A considerable part of underground haulage accidents is due to poor roadbed. Though it is regarded as probable that better roadbeds could be provided in many instances, account must be taken of the economic factor and the fact that only the main haulageway will be used long enough to justify thoroughly substantial construction.

One of the difficulties in the study of these accidents arises because of the absence of statistics. Despite the fact that more than $600,000 annually is made available by the government for the study of safety in connection with rail transportation on the surface, no money has been appropriated for studies of rail transportation underground, which handles half as much tonnage. The Bureau of Mines has made some study of the matter, but the work has been limited by such small sums as could be diverted from the amounts assigned to other branches of mine safety work. The increasing rate of haulage accidents in mines is giving rise to a demand that the government give more attention to studies looking to their reduction.

No Gold Yet From P. B. C. Mines, Ltd.

The report, of recent date, to the effect that the P. B. C. Mines, Ltd., at Masset, Queen Charlotte Islands, had installed and put its plant in operation for the extraction of gold from the black sands of that district, was premature.

There is much excitement among prospectors and residents of the region in which the company has been established; practically all the promising ground has been staked; and there has been an exodus of prospectors from the Prince Rupert district, but the statement that the P. B. C. Mines, Ltd., had recovered gold in material quantities and had shipped the metal was apparently incorrect.

Herman Block, of Baltimore, vice-president of the company, has stated that the plant is nearing completion and that it will be capable of handling 150 tons of concentrates a day. This installation is at Masset Inlet and D. S. Willemar has been appointed manager as well as assayer and chemist. There also is a small plant at Rose Spit, where there has been some extraction. Mr. Block was not prepared to make a statement regarding the results of these preliminary operations when questioned recently.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Nighthawk Peninsula Mills $8 Heads for an Operating Profit

Hollinger Finds Petzite—Lake Shore Recovers $65,000 in Fifteen-day Run—Argonaut Bonds

Toronto, Sept. 19 — The Nighthawk Peninsula mine, in Porcupine, is getting into better condition, and is making a profit. Before the mill was started reserves were stated to be about 200,000 tons of $11 ore, but after milling began, the grade was found to be nearer $6. Some new orebodies have been found, however, and in August the mill heads averaged over $8 a ton and costs were under $6. To carry on an extensive development and sink a much needed new shaft, further money should be raised.

The Hollinger recently encountered a body of ore carrying a considerable quantity of the telluride petzite. It is not known yet whether or not this will be of great importance, but typical samples ran over $10,000. It is considered interesting as being the first time this mineral has been found in the mine.

During the first fifteen days of September the Lake Shore mill, of Kirkland, established a new record of production by recovering a total of $65,000. The mill treated 3,660 tons, or an average of 244 tons a day, of $17.76 ore.

The Continental is sinking about 165 ft. a month in its new shaft, which is a new record for Ontario. The McIntyre, when it gets going, expects to sink more than 200 ft. a month.

A meeting of the Argonaut shareholders has been called for Sept. 24 to ratify a bylaw providing for an issue of $500,000 of bonds. The bonds will bear interest at 8 per cent, will be redeemable at 120, and will carry the privilege of conversion into an equal par value amount of common stock. The funds will be used to provide additional mill capacity and equipment and to carry out an extensive program of development.

During the month of August the Nipissing company, of Cobalt, produced 232,500 oz. of silver, of an estimated net value of $170,390, and 202,518 oz. of bullion, of an estimated net value of $139,149. At 73 shaft a new vein showing 1½ in. of 2,000-oz. ore was found. The low-grade mill treated 7,560 tons and the high-grade plant 254 tons.

Accompanying the dividend checks of the Keeley mine, of South Lorrain, was a financial statement showing cash on hand $284,414, bonds to the value of $518,467, and ore on hand, in transit and at the smelters $201,407—a total of $1,001,288.

The Everett mine, in Gowganda, is to be diamond drilled, following a favorable report which indicates the possibility of getting the extension of one of the Castle veins. The Castle is now making a profit of over $40,000 a month. A new vein has recently been found, which has been opened for 50 ft. and shows 2 to 6 in. of 4,500-oz. ore.

Johannesburg Letter

By John Watson
Special Correspondent

July Gold Output, 829,437 Oz., Near Record for Rand

Swelled by 31,000 Oz. from West Springs—New All-Sliming Plant in Regular Operation

Johannesburg, Aug. 18—The monthly output of the Transvaal gold mines for July was declared by the Chamber of Mines on Aug. 9 to be as follows: Total for July, 829,437 oz., having a value of £3,867,250. These figures show an increase of 56,384 oz. over June, equivalent in value to an increase of £214,575. As a monthly output, under normal conditions, that for July is a record. Only once before has it been exceeded, and that was for March, 1912, when a special clean-up was made on account of industrial disturbances. The record figure for July was helped by the inclusion of West Springs' first recorded output—more than 31,000 oz., including gold caught from trial runs, from the new all-sliming plant. The figures for native labor show an increase of 149 "boys" on the gold mines and 156 on diamond mines, compared with the end of June.

Good finds of diamonds have recently been reported from the reserve portion of Zeekoefontein, on the Vaal River. Tromp's reserve yielded 150 diamonds on Aug. 7. He has been averaging 60 carats a day; but this output has now increased. A Potchefstroom digger is said to have taken out £1,000 worth of stones in the first week of August. A Vereeniging digger found one diamond which has been valued at £800.

The annual meeting of shareholders of the National Bank was held in Pretoria on Aug. 8, James R. Leisk, presiding. The profit on the year's business was nearly £203,000. The inconvertibility of Union gold certificates remains in operation until June 30, 1925, or until the market price of standard gold (22 carat) returns to 77s. 10½d. an ounce, whichever is the earlier date. The absence of a free market in gold was a source of the greatest embarrassment. It was the most perplexing and harassing of all the difficulties. The government should investigate, without delay, the problem of an early return to the gold standard. Existing conditions should be taken into account and the return should not be too sudden or drastic.

On Aug. 5, Samuel Evans said: "If the Dawes plan is accepted, Germany will go back to gold. If she does, England will also have to get back to gold." Mr. Evans thinks it is very foolish for us to try to maintain the gold premium; we may have to pay too high a price for that temporary advantage. World stability of prices and exchanges, equal to that which prevailed before the war, is wholly unattainable without the gold standard, notwithstanding its drawbacks.

A deputation from the Certificated Winding Engine Drivers' Association (hoisting engineers) recently interviewed the Gold Producers' Committee of the Chamber of Mines, when the following rates of pay were agreed upon:

On the Surface—(a) For the driver of an engine the load of which is less than 2½ tons, 2s. 7½d. per hour. (b) For the driver of an engine the load of which is 2½ tons or more, 2s. 10½d. per hour. Underground — (a) For the driver of an engine the load of which is less than 2½ tons, 2s. 9¾d. per hour. (b) For the driver of an engine the load of which is 2½ tons or more, 3s. 1d. per hour.

Union Minière Passes 20,000,000-Lb. Mark in Copper Output

AUGUST copper production for the Union Minière du Haut Katanga was 9,257 metric tons, or 20,411,685 lb. The figures for the last four months show the remarkable growth in the output of the big producer in the Belgian Congo. They are: May, 14,215,635; June, 16,056,810; July, 18,861,570; and August, 20,411,685 lb. When will it stop?

Hammon Consolidated Launches Third Gold Dredge at Nome

The third gold dredge constructed for the Hammon Consolidated Gold Fields Co. at Nome, Alaska, was successfully launched on Sept 2. The construction of the hull was started on June 24, and required thirty-nine days for completion. The hull is 140 ft. by 56 ft. by 11.6 ft. deep. It will be electrically operated and equipped with 9-cu.ft. buckets.

The maximum depth of dredging will be 60 ft. E. A. Weeks, construction superintendent, and a working crew of ninety-three men are now engaged in installing the machinery. It is expected that the dredge will be completed by Oct. 15 and it may be finished two weeks in advance of that date, according to the Yuba Manufacturing Co., the builders.

Homestake Will Fill Old Stopes Under Lead City

To prevent the danger of buildings and streets at Lead, S. D., caving into the abandoned workings of the old Independence mine, which are 300 ft. below the corner of Main St. and Gold St., the Homestake Gold Mining Co. has started operations which will result in the old mine workings being filled with the tailings from the cyanide plant.

About fourteen years ago two caveins occurred. Another opening yawned on the east side of Gold St. near the hill that marks the street's termination. A churn drill has been set up at the street intersection, and it will bore an eight-inch hole to the large cavity below. Tailings will be trucked to the spot and washed down the eight-inch hole with water.

The rotting of timbers in the old mine made it necessary to take some precautions, because of the great weight of the buildings and traffic above.

London Letter

By W. A. Doman
Special Correspondent

Pri-Amur Syndicate Tests Silver-Lead Property in Siberia

Long Concession Confirmed by Supreme Council—Soviet Gets 5 per Cent Gold Royalty

London, Sept. 9—The Pri-Amur Syndicate, that is testing a silver-lead property in eastern Siberia, has dispatched an engineer to the mines, traveling by the Trans-Siberian Railway. The areas to be examined are immediately to the north of the Brinner's Zinc Mines, which were equipped and worked by Aron Hirsch before the war. The Brinner's Zinc Mines are connected by a light railway with Fetuche, a port on the Sea of Japan. The syndicate, which has numerous properties to investigate, is formally recognized by the Soviet regime in control of the Primorsk district of eastern Siberia and is confirmed by the Supreme Council in Moscow.

The concession embraces 68 mines and 108 mining claims. Should the areas turn out as expected, they will be important producers of base metals, as well as iron ore and coal. The leases are for the expected life of the mines. The tax payable to the Soviet is fixed at 5 per cent on the value of gold obtained, with considerably reduced percentages on the less valuable mineral products. It is said that the Soviet attach great importance to the local industrial developments which will follow on the mining operations to be undertaken. The properties were reported upon in 1914 by G. W. Edwards, and his report was examined and commented upon by Professor Henry Louis, in 1919 and 1922.

It is reported that an arrangement has at last been consummated between the technical advisers of the East Rand Proprietary Mines and the Cinderella Consolidated for a joint working of the two areas. The shareholders' committee, which is endeavoring to wrest the control of the former from the Central Mining Corporation, has issued a statement of its case. Taken alone, this seems convincing. But the directors meet each objection, and have apparently done so effectively. A comparison with the Crown Mines in regard to tonnage milled, and with Randfontein Central as to pumping, is scarcely fair owing to depth considerations and local conditions.

I learn privately and unofficially that the engineer of the Anglo-American Corporation paid a visit to Rhodesia and examined the Eileen Alannah mine, which adjoins the Cam & Motor. For some time it has been imagined that the reefs of the Cam & Motor would be found in the Eileen Alannah, but as a result of this examination it is said that, though they may be found later, there is no evidence at present that the Eileen Alannah will prove anything like as rich as the Cam & Motor. The rumor led to the selling of a fairly large block of shares of the former, and lowered the price.

Societies, Addresses, and Reports

Franklin Institute Celebrates Centenary

Distinguished Scientists and Engineers of the United States and from Europe and Canada Meet in Philadelphia— Many Papers Presented

(Staff Report)

WITH an attendance of distinguished scientists and engineers from Europe as well as from the United States and Canada, the Franklin Institute, of Philadelphia, celebrated the centenary of its foundation by a three-day meeting last week. Nearly fifty papers on engineering and scientific subjects were presented at group sessions, and the entire attendance was brought together in three general meetings. The distinguished character of the gatherings can be judged from the names of some of those who presented papers: Sir Ernest Rutherford, of Cambridge University, and Sir William Henry Bragg, of the Royal Institution, the distinguished British physicists; Prof. Charles Fabry, of the University of Paris, the spectroscopist; Dr. F. Haber, of Berlin, inventor of the Haber process of nitrogen fixation; Sir Charles Parsons, of steam-turbine fame, and among our own eminent scientists were Langmuir, the physicist; Dr. Coolidge, who has done so much for the development of X-ray and radio tubes; Professor Michaelson, who has measured the diameter of the stars and is now making a new determination of the velocity of light, and Elihu Thomson, dean of research men in the United States. About 800 men and women attended, many of them the designated representatives of universities and societies of learning in every part of the world.

To summarize adequately the proceedings as a whole would take much space. Various phases of study of the constitution of matter were covered by papers presented, in addition to those by Sir Ernest Rutherford, Sir William Henry Bragg, and Dr. Langmuir, by Dr. Mendenhall, of the University of Wisconsin; Prof. J. S. E. Townsend, of Oxford University; Dr. Pieter Zeeman, of the University of Amsterdam, and Prof. William L. Bragg, of Victoria University. Aeronautics, military engineering, and metallurgy were also covered in groups of papers. In strictly engineering subjects, aside from military engineering matters, there were papers on "The Progress and Promise of Engineering," by Dean Dexter S. Kimball, of Cornell University; "Effect of Loading Granular Material," by Daniel E. Moran; "Progress in Telephony," by General John J. Carty; "Unusual Problems in the Design and Construction of Large Bridges," by Ralph Modjeski; "Steam Turbines," by Sir Charles Parsons; "The Mercury Boiler," by William L. Emmet; and on "Twenty-Five Years' Progress in Explosives," by Dr. Charles L. Reese.

Among the addresses of a general character were the notable papers on "Progress and Promise of Engineering," by Dean Dexter S. Kimball, of Cornell University; on "The Fifth Estate," (being a brilliant estimate of the position of the scientist in the modern world), by Dr. Arthur D. Little, of Boston; on "The Field of Research in Industrial Institutions," by E. W. Rice, Jr., honorary chairman of the General Electric Co., and a very brief but thought-provoking address by Dr. F. Haber at the centenary banquet.

Illustrating the influence of industrial research in modern life, Mr. Rice, in his paper on research in industrial institutions, pointed out that in one company in which a survey was made recently it was found that not fewer than 15,000 men were employed in making products which had been developed in the research laboratory and that the value of these products was $60,000,000 a year. He stated, also, that if the present candle-power of incandescent lamps were produced by carbon filament lamps, instead of the present-day Mazda type, the current bill of the country would be increased by $1,000,000,000 per year.

Professor Michaelson gave the preliminary results of a new determination of the velocity of light. These results, he believes, are accurate within one part in 10,000, but, with certain improvements in the apparatus, he expects next year to secure a much greater accuracy and to determine the velocity of light within one mile per second. His determination in these recent experiments gives the velocity of light as 299,820 km. per second (186,300 miles per second).

The concluding ceremony of the celebration was a banquet, at which the delegates from universities and societies of learning presented their congratulations to the Franklin Institute.

. . . . .

Franklin Institute was founded in 1824 under the inspiration of two young Philadelphians, Samuel V. Merrick, and Prof. William H. Keating, of the University of Pennsylvania. The objects as given in its charter, granted that year, were "The promotion and encouragement of manufacturers and the mechanic and useful arts, by the establishment of popular lectures on the sciences connected with them, by the formation of a cabinet of models and minerals, and a library, by offering premiums on all objects deemed worthy of encouragement, by examining all new inventions submitted to them, and by such other measures as they may judge expedient."

Under this charter the Institute has had a steady growth in membership and prestige, there being now 1,300 members. From the beginning, distinguished scientists and engineers have presented the results of their work before the Institute and have had their achievement recognized through the award of the medals of the organization. Among recipients of its medals have been Thomas A. Edison, Guglielmo Marconi, Professor Michaelson, Sir Charles Parsons, Sir Joseph Thomson, Frank J. Sprague, Ralph Modjeski, General John J. Carty, Alfred Noble, Sir Robert A. Hadfield, Henri Moissan, Dr. Michael I. Pupin, Professor Roentgen, and Elihu Thomson.

The Institute has played an important part in the scientific, technical and manufacturing life of Philadelphia. Among its efforts were the holding of the first large electrical exhibition and the inception of the idea of the Centennial Exposition at Philadelphia in 1876.

Engineers have always played an important part in the management of the Institute. Among the presidents have been Coleman Sellers, William Sellers, and John Birkinbine. The president at the present time is also an engineer, Dr. William C. L. Eglin.

Senator Oddie Talks to Bankers

Points Out How Stabilization of Exchange Will Benefit Industry

The benefits to American industry which would follow a stabilization of exchange with other countries were pointed out in detail by Senator Oddie, of Nevada, in the course of an address on Sept. 19 before the Nevada Bankers Association, meeting at Elko, Nev. The Senator also pointed out the steps which have been taken by the Senate Commission of Gold and Silver Inquiry, of which he is chairman, to improve the situation.

Northwest Convention Date Set

The Northwest Mining Convention will be held at Spokane, Wash., Dec. 1 to 6 inclusive, according to an announcement made by F. C. Bailey, secretary and treasurer of the Northwest Mining Association, under the auspices of which the meeting is held.

Arizona Mining Men Meet at Globe

On Sept. 15 and 16 the mining men of the Globe district, Arizona, were hosts to the Arizona chapter of the American Mining Congress. G. M. Colvocorresses, manager of the Humboldt smelter, presided at both sessions on the first day and W. B. Gohring acted as secretary. Papers were read on the Inspiration leaching plant by H. W. Aldrich, on the Magma smelter by Superintendent Rose, on the Magma mine by Assistant Mine Superintendent Snow, and on the Colorado Compact by A. G. McGregor.

In discussing the Colorado Compact Mr. McGregor said that 5,000,000 hp. could be developed on the Colorado River in Arizona, which at $20 per horsepower would have an annual value of $100,000,000. He advocated the appointment of a state non-partisan commission which would have three objects —first, to find out whether Arizona has the right to tax power produced in Arizona but used outside the state; second, to recommend a policy for the state in matters pertaining to the development of the Colorado, and third, to negotiate with applicants for permits to construct dams along the river.

Christopher Robert Corning

By T. A. Rickard

C. R. CORNING, one of the leaders of the mining profession in the United States, died at Chatel-Guyon, near Royat, France, on July 2. He was sixty-five years of age, and had been an invalid for two years in consequence of a paralytic stroke from which he had never entirely recovered. On his way from New York to France he received the news of his father's death, and this undoubtedly hastened his own end, for he was an affectionate son and brother.

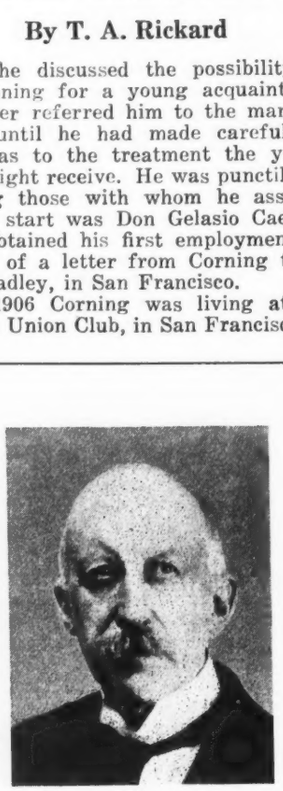
My friend—as I am proud to claim him—was born in New York in 1859, but he was educated in Europe, first at a grammar school at Zurich, in Switzerland, and then at the mining academy of Freiberg in Saxony. Later he continued his post-graduate studies at Heidelberg university, under such celebrated teachers as Bunsen, in chemistry, and Rosenbusch, in petrography. From Heidelberg he received the degree of Ph.D. in 1883, but he never used the title. This was characteristic.

For three years thereafter he traveled among the mines of Spain, France, England, Italy, Germany, and Austria, in preparation for his career as a mining engineer in the United States, to which he returned in 1886.

A year later he was on the staff of John F. Stevens when that engineer was building the Duluth, South Shore & Atlantic Railway. In 1889 he was consulting engineer to the Bunker Hill & Sullivan Mining Co. in Idaho. It was there that he first met E. E. Olcott, with whom he formed a partnership in 1897. Their firm included Percy E. Fearn for a time. Robert Peele, professor of mining in Columbia University, was a partner from 1897 to 1904. With the professor he translated, from German into English, Riemer's book on "Shaft Sinking Under Difficult Conditions," in 1902.

Each of Corning's partners testifies to his unusual personality, marked by apparently contradictory traits, but interesting and lovable. They speak of him as a man with whom it was a privilege to work; he was a keen student, a careful reader, a highly educated engineer, endowed with a tenacious memory and a genuine love for scientific inquiry. His knowledge of economic geology was extensive; and if he had not been a man of independent means he might have won high rank as a specialist. He lacked the urge of necessity; therefore his scientific study was that of an amateur in the true sense of the word—he did it for the love of it. Stanly Easton, now the manager of the Bunker Hill, testifies to his continued interest in the mine, and more particularly his abiding regard for the technical men with whom he had worked in former days. He never failed to be cordial and hospitable to them when they came to New York and called on him in his office at 36 Wall Street. "He was," says Easton, "the most kindly and courteous of men, and keenly interested in the progress and welfare of young engineers," and when he discussed the possibility of an opening for a young acquaintance he never referred him to the management until he had made careful inquiry as to the treatment the young man might receive. He was punctilious. Among those with whom he assisted at the start was Don Gelasio Caetani, who obtained his first employment by means of a letter from Corning to F. W. Bradley, in San Francisco.

In 1906 Corning was living at the Pacific Union Club, in San Francisco, at the time of the earthquake-fire, from which he escaped with characteristic ease, obtaining shelter and hospitality at a friend's house in the country. In 1911 he was consulting engineer to the Huanchaca Mining Co., which operated the celebrated silver mine in Bolivia from headquarters in Paris. That brought him thither. He came occasionally to London, where I happened to be as editor of the *Mining Magazine*. Corning would ask me where he could procure sundry mining supplies or he would ask for the names of manufacturers, and I would pick up a copy of the magazine to give him the required data. He said to me one day: "I suppose I ought to subscribe for that damned thing," smilingly. I replied that there was no need for him to do so, as I was delighted to give him the information. Not long afterward he invited my wife and me to spend a week-end with him as his guests in Paris. The memory of those four days is one we shall cherish so long as we live. He was princely in his hospitality to his friends; not in the mere spending of money, but in attending to details that would conduce to their comfort or pleasure.



Christopher Robert Corning

He maintained a close touch with European affairs and possessed unusual insight into international politics. His early training had made him well informed on such matters, and his knowledge of several foreign languages, including, of course, French and German, enabled him to be a regular reader of various scientific and political journals. Throughout his life he showed an intellectual curiosity concerning governments and peoples all over the world, but especially Europe. He was the least like an isolationist. Moreover, he crossed the Atlantic at frequent intervals, and also maintained a regular correspondence with his sister and brother, who lived at Geneva. He was a correspondent of the old-fashioned kind, as his many friends will remember gratefully. Although anything but expansive about his own affairs, he was keenly interested in those of his friends and was quick to come to their assistance, or even to go out of his way to do an act of courtesy in behalf of the friend of a friend. He was a highly civilized being.

In 1912 when the American Institute of Mining Engineers drifted upon the rocks, and a serious fiasco seemed impending, he departed from his habitual detachment from such matters and came forward for the purpose of reforming the management of the Institute. With W. R. Ingalls, J. Parke Channing, James F. Kemp, and other leading members he took the bull by the horns, the result being the election of a committee, of which he was the leading member, and by which an unpleasant tangle was straightened, so that finally the Institute's management was reorganized successfully. Most of his opponents in this affair, and even some of his associates, thought him harsh in his attitude to those adversely affected by the inquiry. My own conviction, as one absent at that time and in no way participating in the conflict, but with close friends on both sides, is that Corning deserves the gratitude of our profession for his uncompromising sincerity of purpose and for his persistent energy in bringing matters to a definite issue. I do not believe that he was "vindictive," as has been alleged, but that he exhibited his usual contempt for half-measures and had a clear idea of the need for seeing the affair through to its logical conclusion. He was sincere and uncompromising, then, as always, to a degree that seemed unamiable, naturally, to the friends of those whom his actions affected unfortunately. Subsequently, when approached with suggestions of office in recognition of his services, he declined any such compliment. He was also a prominent member of the Mining & Metallurgical Society of America, in the affairs of which he took a warm and helpful interest. He served on the Committee of Standards.

In later years he spent much of his time at Tuxedo. He became fond of fly-fishing, in which he was expert. During the war he served on several committees appointed by the Union League Club, of which he was a prominent member. He was intensely opposed to anything that savored of anarchy. In politics, his attitude was so conservative as almost to be that of a Tory. In social and professional matters he was an aristocrat; he was dignified in demeanor and charmingly courteous to his equals, with a tendency

to brusqueness toward inferiors. He cherished high ideals of professional conduct and much contempt for shoddy ways. He was a stickler for the proprieties. When a kinsman approached him and some friends at a club, soon after he had returned from the examination of a mine, and casually asked him what he thought of it, he was indignant at the question, and expressed surprise afterward that anyone should suppose that he would divulge to others information that belonged solely to his clients.

He did not suffer fools gladly, and was not easy of approach to strangers, but he had a genius for friendship, by reason of an innate kindness and courtesy. He was a man of strong convictions; he saw few things in half-shade, and seemed therefore blunt sometimes. His mind was mathematical in its treatment of problems, including those problems of human nature which are not susceptible of mathematical treatment. He had strong prejudices; nevertheless, he possessed an open mind and would listen fairly to contrary evidence. George C. Stone says: "I have never met a man who was more anxious to get at the truth and to have full justification for what he did and said." Another friend, Robert Peele, testifies: "He had a penetrating judicial mind; he despised vague opinions, and rejected generalizations when it was at all possible to be definite and precise." Difficult he may have been sometimes, even irascible to strangers, but intellectually honest always. He was a keen and just interpreter of human events, a sagacious commentator, and a delightful companion. A consistent member of the Opposition, he was a clever critic of world affairs, a condemner of its vast stupidities and inanities, and a despiser of its insincerities. He was deeply interested always in the welfare of his profession and of his country. He was a staunch friend and an outspoken enemy. Christopher Corning was an American gentleman of the Old School.

Men You Should Know About

R. R. Seeber, mining engineer of Houghton, Mich., has just returned to that city after examining claims in southern California which are being worked for arsenic.

Louis D. Huntoon, consulting and mining engineer, left New York on Sept. 22 to examine mining properties in the Larder Lake and Lightning River gold areas, in Canada.

W. Val de Camp, former underground superintendent of the United Verde Extension, has been promoted to the position of general superintendent of mines.

H. Dewitt Smith will relinquish his position with the United Verde Copper Co. at Jerome, Ariz., on Oct. 1, to accept a place in the industrial department of the New York Trust Co.

H. D. Budelman, mine superintendent for the West End Consolidated Mining Co., has returned to Tonopah from a several weeks' vacation and business trip to various parts of California.

A. P. Thourkauf, formerly of Toronto, has been appointed chief engineer of the Dominion Steel & Iron Co.'s Sydney plant and its subsidiaries at North Sydney and New Glasgow, N. S.

Thomas W. Gibson, Deputy Minister of Mines for Ontario, has returned from an extended visit to England and resumed his duties. He reports a remarkable awakening of interest in Ontario mining enterprises among British financiers.

C. H. Mace, general manager of the Mace company, of Denver, Colo., left that city on Sept. 17 on an extended trip through Washington and Oregon, in connection with smelter installations in the Northwest, particularly in Gold Hill, Ore., and Oroville, Wash.

Hamilton B. Wills has resigned as president of the Keeley, Vipond, Canadian Lorrain, and Gilgreer mining companies, owing to ill health, and **F. H. Hamilton,** of London, England, representing British interests in these companies, has been appointed president, **J. M. Bell** remains managing director and **R. S. Denning** has been elected secretary.

Obituary

John Dixon died suddenly on Sept. 12, at Medford, Ore. He was a Canadian by birth. For some years he was associated with the Thompson-Gunn properties and had charge of mechanical work at Mason Valley, Nev. He was an experienced metallurgist. With W. L. Austin he participated in the classic pyrite smelting tests of Toston, Mont.

Captain Harry George, U. S. N., retired, one of the pioneers in the organization of the Copper and Brass Research Association, is dead. He had been conspicuous in the association's activities and had contributed valuable data to its research program. The board of directors of the association on Sept. 18 adopted complimentary resolutions of appreciation and sympathy to Captain George's family.

W. H. Picher, of Joplin, Mo., one of the pioneers in the lead-smelting industry of southwest Missouri, died at the St. Luke's Hospital, St. Louis, Mo., on Sept. 15 after an illness of three weeks from heart disease. He was seventy-four years old. Mr. Picher was one of the organizers of the Picher Lead Co., of Joplin, Mo., which later merged with the Eagle Paint Co., of Cincinnati, Ohio, as the Eagle-Picher Lead Co. about fifteen years ago. The funeral was held at Joplin on Sept. 19.

R. H. Bowlby, formerly student of the Montana School of Mines, who for the last two years had been engaged in mining at Ruth, Nev., was killed in an underground cave-in there on Sept 7. Bowlby was born in Marysville, Mont., in December, 1895. He attended the public schools of Butte and Boulder and was graduated from the Lee, South Dakota, high school. In 1918 he entered the Montana School of Mines, where he was very active in athletics and prominent in student activities. Interment was at Salt Lake City, Utah, on Sept. 10.

Harry H. Nell, assistant superintendent of the reduction works of the Anaconda Copper Mining Co., at Anaconda, Mont., died in that city on Sept. 17, from the effects of a paralytic stroke. Mr. Nell was born on a farm in Adams County, Penn. on Nov. 11, 1857. He remained on the farm until 1880, and then went to Denver, Colo. On Oct. 21, 1889, he came to Anaconda, and entered the employ of the Anaconda Copper Mining Co. as traffic clerk and had been in the employ of the Anaconda company at Anaconda, ever since.

H. C. Anchor

Fifty years ago, after experience in a coal mine in Denmark at which his father was superintendent, H. C. Anchor emigrated, at seventeen years of age, to the United States. His destination was Carson City, Nev., where a brother lived. From there he went to Virginia City, coming in contact with Captain J. R. De Lamar, by whom he was employed subsequently in reconnoissance, exploration, and development work. After responsibility in connection with the opening of the De Lamar mine in Idaho, Mr. Anchor went to Shasta County, Calif., where he located for Captain De Lamar the since famous Bully Hill mines. In 1910 professional travel took him to the Porcupine district of Ontario, at a time when transportation facilities were lacking between the outside world and the district now famous for its gold mines. Work in Canada subsequently occupied much of his time, although his home was in Sacramento, Calif. His most recent trip thither terminated in October, 1923. In May of this year he went to Idaho to examine and report on a property for eastern clients, and while there was taken ill. He completed the examination, however, and returned to Sacramento on Aug. 10. On Aug. 17 he was operated on for appendicitis, from the effects of which he died on Aug. 22. Mr. Anchor, who was a member of the Institute, leaves a widow, a son and four daughters.

H. C. Anchor

Recent Technical Publications

Reviews, Abstracts, and References

All About the Uses of Lead

Lead, the Precious Metal. By O. C. Harn. The Century Co., New York. Price $3.

The author of this work must have chosen the designation "precious metal" when lead was selling for over 9c. a lb. early this spring, though even 8c. lead will not exactly drive the producers bankrupt. Or, maybe, by "precious" he refers to the broad field of utility of the metal, which he so capably discusses in the book, and the lack of a satisfactory substitute for the metal in many of its uses.

A few pages are devoted to mining and smelting. Then the author, who is advertising manager of the National Lead Co., tells in successive chapters how lead is used in paint, building construction, babbitts and solders, printing, lead sheets, chemical industries, petroleum refining, ammunition, musical instruments, glass, pottery, rubber and many other uses which are difficult to classify. Mr. Harn gives a lot of interesting information about the industries that he discusses, and all in language which any one can understand.

There will be few readers who do not learn a great deal that they did not know before, even though they may consider themselves fairly well informed on the uses of metals. Does the reader of this reveiw, for example, know about the peculiar qualities of frary metal and of what percentage of lead it contains; or about the use of titanium oxide in paint; or that lead tetraethyl will prevent an automobile engine from knocking when it is foul with carbon. Incidentally, though the author does not say so, it is this lead tetraethyl that is used for doping the gasoline that is now being sold as "ethyl gas."

Most of Mr. Harn's statements are technically correct, and unprejudiced, though an occasional slight slip may be noted. The Cottrell process is given a little more credit than it deserves, for example, when he says that by its use "the air in the neighboring houses, gardens, and orchards is thus rendered normal.

"Every one who has ever felt depressed by the red vegetation-denuded waste in the vicinity of the copper smelters of northern California and other mining regions cannot help feeling grateful that such destruction is no longer necessary." Also, the attention of the Copper and Brass Research Association and the American Zinc Institute is respectfully called to the statement on page 46 that "lead, either pure or hardened, is the best possible material, not only for the uses mentioned (roofs and gutters), but for such related purposes as copings, flashings, moldings, cornices, gargoyles, skylights, etc."

A particularly complete index to the work is appended, even including a reference to Sherlock Holmes.

E. H. Robie.

Engineering in American Industry. By Conrad Newton Lauer. A lecture delivered at Princeton. McGraw-Hill Book Co., New York. Price $2.50.

The lecture is brief, but holds the attention and the interest. The illustrations, which presumably the lecturer used as screen pictures, formed the most vivid part of the exposition as to how an American industry has grown, and how largely this growth has been the result of engineering inventions and improvements. It is a fascinating volume, easy reading for the layman, instructive as a reference book for everybody. Sixty-one of the illustrations are charts which illustrate graphically the stupendous growth of engineering application and industry and the parallel advancement of prosperity in the United States. This volume has helped us to visualize more than any other publication, why and how the United States is what it is. Having looked it over with the profoundest interest, we shall keep it on our shelves as a reference book.

Geology and Gold Resources of North Central Idaho. By Francis A. Thomson and Samuel M. Ballard. Bulletin No. 7, Idaho Bureau of Mines and Geology; 1924. University of Idaho, Moscow, pp. 123, 6x9 in.; figs., 15; plates, 27.

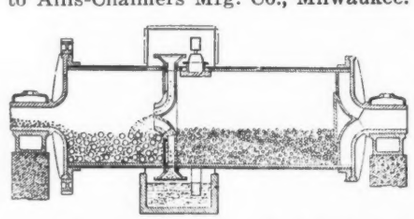
This report will be of great interest to the people of Idaho and to those who are interested in the development of Idaho's mineral resources. It is terse and readable; the views concerning the nature and future of the ore deposits are set forth in clear language.

J. E. Spurr.

New Patents

Grinding Mills—No. 1,503,703. Aug. 5, 1924. E. H. Moyle, Los Angeles. A roller mill for grinding ores.

No. 1,504,777. Aug. 12, 1924. R. C. Newhouse, Wauwatosa, Wis., assignor to Allis-Chalmers Mfg. Co., Milwaukee.



A two-compartment cylindrical ball mill with means for introducing the feed both at the end and along the length of the mill, as shown in the accompanying illustration. Patent No. 1,504,778 issued to the same applicant and similarly assigned, relates to a screen for use in a mill of this type.

No. 1,506,120. Aug. 26, 1924. H. W. Hardinge, New York, assignor to the Hardinge Co., Inc., New York. Means for passing air through the outlet trunnion of a Hardinge mill for the purpose of facilitating the passage of dry ground material.

Pneumatic Separators—A series of patents on pneumatic ore-dressing machinery has been issued to Albert H. Stebbins, Los Angeles. No. 1,504,280, for a concentrating device, was issued Aug. 12, 1924. Those issued on August 19 include Nos. 1,505,734-5-6-7-8 for concentrating tables, No. 1,505,739 for a pneumatic sizer, Nos. 1,505,740-1-2 for pneumatic concentrators, and Nos. 1,505,743-4 for separators for removing liquids from gases.

Flotation—Nos. 1,505,323-4. Aug. 19, 1924. G. B. Eberenz, El Paso, Tex., assignor of one-fourth to E. P. Mathewson, New York, and three-fourths to T. J. Scanlon, Alton, Ill. Hydrogen sulphide under pressure is brought in contact with the ore pulp in a flotation machine, air also being admitted either at the same time or subsequently, the sulphidized mineral particles appearing in the froth.

No. 1,505,944. Aug. 26, 1924. Walter Broadbridge and Edwin Edser, London, England, assignors to Minerals Separation Ltd., London. An emulsion is agitated and aerated so as to form a froth preferentially carrying one constituent of the emulsion.

No. 1,506,385. Aug. 26, 1924. F. H. Rhodes, Philadelphia, assignor to The Barrett Co. A process of making flotation oil which comprises the removal, by extraction with an acid, of pyridine bases from a hydrocarbon oil, prepared from coal tar distillates for flotation purposes, and then neutralizing the acid in the oil by agitating it with a solution of the alkali salts of tar acids.

Electrolysis—No. 1,505,494. Aug. 19, 1924. Richard Rodrian, New York, assignor to Hans Adelmann, New York. A process of electrolyzing a ground metal-bearing mass in the presence of an alkaline electrolyte, producing in the electrolyte a solid product containing a metal constituent. This solid product is subsequently washed and dried and the metal which it contained is recovered.

Electric Furnace—No. 1,505,495. Aug. 19, 1924. Richard Rodrian, New York City, assignor to Rodrian Electro-Metallurgical Co., Inc., N. Y. A crucible furnace with insulated walls, heated by fuel burned in several nozzles projecting through the walls. The molten mass is then treated electrolytically by passing a current from a suspended cathode through the contents of the crucible to a plate on which it rests, and thence back to the source of current.

Mine Rail Ties—Nos. 1,505,806-7-8. J. J. Ross, Huntington, W. Va. Metal cross ties for mine rails, with clamping lugs adapted to secure rails of different sizes.

Metallurgy of Tin—No. 1,506,053. Aug. 26, 1924. C. G. Fink, Yonkers, N. Y., assignor to Guggenheim Bros., New York. Tin-bearing ores are heated without sintering and brought into contact with a gaseous reducing agent, thus reducing the compound of tin to the metallic form without fusing the material.

New Machinery and Inventions

A New Straight-line Two-stage Compressor

THE low power consumption per cubic foot of air delivered and favorable physical conditions of the air resulting from two-stage compression have long been recognized by compressed-air users, but the initial cost of the compressor and the cost of installation have heretofore overbalanced these favorable features, with the result that only machines of large capacity have been available—the majority of which have been of the duplex construction. Such construction, though entirely logical for machines of more than 500 cu.ft. piston displacement, has proved too expensive to manufacture for smaller capacities, besides being too costly to install, because of the complicated foundation required and the nicety essential in aligning the machine; furthermore, the average compressed-air user has in the past neglected to look carefully into the power costs involved in operating the single-stage air compressors of smaller capacities. Now, however, the economies required by present highly competitive business conditions make it necessary that every operating cost be reduced to the minimum, particularly power costs.

To meet the conditions outlined above, the Chicago-Pneumatic straight-line two-stage belt or motor-driven air compressor designated as Class N-CTB has been developed. Operating at 275 r.p.m. this compressor has a piston displacement of 360 cu.ft. of free air per minute; air pressures range up to 125 lb. It is adapted to be driven by a belt or by a synchronous motor with rotor mounted directly on the compressor crankshaft.

Tandem construction is used in this unit, in which the low-pressure cylinder is placed next to the frame and the high-pressure cylinder is connected to the low-pressure cylinder by means of a tandem piece through which the piston-rod stuffing boxes are easily accessible. The intercooler is rigidly mounted above the two cylinders, in which location it is convenient for cleaning, which may be done from either end. The whole unit is mounted upon a substantial sub-base which gives the rigidity so desirable in a machine of this class. Perfect alignment of the machine is assured, resulting in maintained high mechanical efficiency and consequently prolonged life. This feature also gives the unit a degree of portability not realized in duplex construction, and for this reason it may appeal to those compressed air users who frequently employ semi-permanent installations.

On first thought it might appear that the bearing pressures in such tandem construction are unusually high, but this is not the case, as the maximum pressures are even lower than those found in single-stage machines of equal size.

Features of the unit are its accessibility and ease of adjustment. The bearings are readily got at and adjusted with a maximum of exertion. Especially is this true of the wedge-adjusted connecting-rod bearings, which are so easily and conveniently adjusted that the operator is encouraged to keep them in perfect condition, thereby eliminating the most frequent cause of compressor failures.

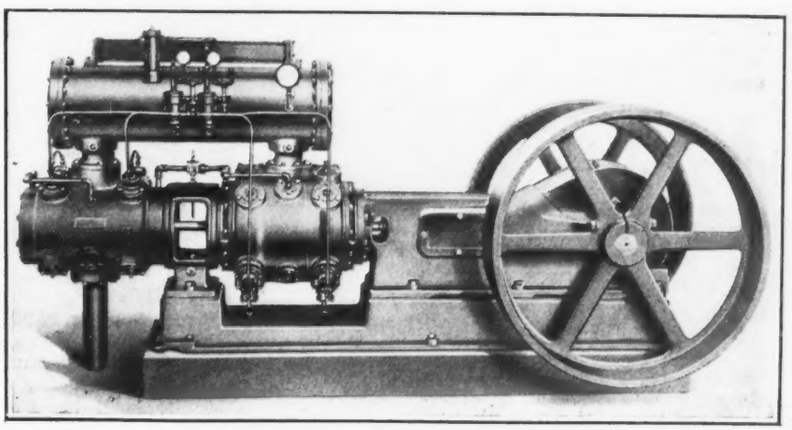
Simplate air valves are used throughout, assuring high efficiency and trouble-proof operation of the most vital part of the compressor.

Automatic operation is attained in a high degree. Splash and flood system of lubrication is employed for all bearings, and the cylinders may be lubricated by the standard sight-feed lubricator, by a pneumatically operated force-feed lubricator or by a mechanically driven force-feed lubricator.

Regulation of the volume of air and its pressure is entirely automatic and can be furnished to conform to the special conditions of the demand for air. Three-step capacity regulation is regularly furnished in which two differential unloaders operating automatic unloading simplate inlet valves cause the compressor to operate at full, half, and no load, according to the air demand, with maximum efficiency and evenly distributed crank-shaft torque. Such operation results in splendid load characteristics for the driving motor, as the steps are clearly defined in loading and unloading obviating any surges in the power line that would otherwise result.

When the air demand is fairly constant for periods in the day with intervening periods in which there is slight or no demand for air, and the compressor is driven by an electric motor, automatic start and stop control operation can be employed, in which circumstance the unit is equipped with a certrifugal unloader which causes the automatic unloading Simplate inlet valves to be held open during the period in which the compressor is at a standstill and to remain open until, in starting again, the compressor has nearly reached normal speed, when the valves are again allowed to operate. During slowing down prior to stopping, the unloader comes into action, throwing the load off the compressor and thereby eliminating much objectionable slapping of the belt in the case of a belt-driven unit. Complete automatic operation of the unit with utmost economy is effected through the use of the Chicago-Pneumatic water control valve, which automatically stops the flow of cooling water through the jackets and intercooler during periods in which the compressor is at a standstill, and allows it to flow when the compressor is in operation.

Again, if operation of the compressor is by electric motor, and air demands during a prolonged period of the day are large and steady, while at other prolonged periods of the day they are intermittent, a combination of the two systems above described can be employed to advantage, it is claimed, either of which can be thrown into operation in a few seconds.



Accessibility and ease of adjustment are among the features claimed for this new straight-line two-stage compressor

Trade Catalogs

Fans—Bulletin No. 1,101 of the American Blower Co., Detroit, Mich., recently received, is a two-page leaflet, descriptive of Sirocco fans. Another leaflet, bulletin No. 1,813, gives in a drawing a suggested method of installing a No. 2½ reversible Ventura fan in the wall of a domestic dwelling.

Oxy-Acetylene Welding—The August number of "Oxy-Acetylene Tips," which is issued by the Linde Air Products Co., 30 East 42d St., New York City, has come to hand. The purpose of this publication is stated to be to present to the users of Linde products various ideas that may be of help and profit to them.

Conveyors—Bulletin No. 1,015 of the Hyatt Roller Bearing Co., Newark, N. J., which has just been received, contains 24 pages of illustration and text descriptive of the use of Hyatt roller bearings for conveyors.

Pumps—A series of bulletins, old and new, but bound together for convenience, and describing vacuum pumps and air compressors of various types, has been received from the Pennsylvania Pump & Compressor Co., Easton, Pa.

The Market Report

Daily Prices of Metals

Sept.	Copper, N. Y. net refinery	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
18	12 75	47.125	47.625	8 00	7.825@7 85	6.15
19	12 75	46 50	47 00	8.00	7 82⅝@7 85	6 15
20	12.75	46.50	47.00	8.00	7.825@7.85	6 125@6 15
22	12 725	45.125	45 625	8.00	7.825@7.85	6.10@6 125
23	12 725	45 875	46 375	8.00	7.825	6 10
24	12.725	46.625	47.125	8.00	7.825	6.10
Av.	12 7375	46.292	46.792	8.00	7 833	6 125

*These prices correspond to the following quotations for copper delivered: Sept. 18th, 19th and 20th, 13.00c.; 22d, 12.975c.; 23d, 12.975c.; 24th, 12.975c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
18	62½	63½	66½	235½	237⅜	32⅞	32⅜	32⅞	32⅝
19	62¼	63¼	66½	233½	235½	33⅛	32½	32⅞	32⅝
22	62	63	66¼	227¾	229½	33	32½	32⅝	32½
23	62	63	66	227¾	229½	32¾	32¼	32⅝	32⅜
24	62	63	66¼	233	235	32⅞	32½	32¼	32⅜

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver		Gold London	Sept.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
18	4.46	69⅜	34⅞	92s 05d	22	4.45¾	69¼	35	92s07d
19	4.45⅜	69⅛	34 11/16	92s 09d	23	4.45½	69⅞	35 1/16	92s09d
20	4.46⅛	69½	34 13/16	....	24	4.46⅜	69⅞	35	92s07d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Copper, Lead, and Zinc Markets Dull

New York, Sept. 24, 1924—The copper, lead, and zinc markets have been unusually quiet during the week. All three registered slight declines. Silver again established a new high mark for the present long-continued upward movement, of 69⅞c., and tin furnished the feature of the week so far as violent price fluctuations are concerned, declining two cents per pound in three days and then recovering nearly all the ground lost. The dullness of the principal markets is attributed to the declines which have recently occurred and which have caused buyers to hesitate to purchase requirements.

Copper Slightly Easier

Sales of copper have been light. More metal was sold to consumers abroad than to domestic buyers. The price generally obtained for the copper sold was 13c. delivered, but some shading of this quotation has taken place, a moderate amount being sold at 12.90c. It is not surprising that business in copper has been so quiet, because buyers seldom participate in a declining market, and copper has been declining for several weeks. Their unwillingness to enter the market merely accentuates the anxiety of some producers to sell, particularly those who must sell a definite quantity of copper regularly. Copper is reported to be offered abroad at 13.10c., c.i.f. Some of the larger copper sellers have preferred to remain out of the market at present levels, but have not lost many sales by doing so. Not only is there an absence of demand from consumers, but also a noticeable decrease in inquiries. The London market has kept fairly steady. Representatives of copper companies returning from Europe are highly optimistic over the prospects of increased buying abroad.

Lead in St. Louis Weaker

The official contract price of the American Smelting & Refining Co. continues at 8c. per lb., New York.

For several weeks the lead market has been quiet, an unusual condition, for sales are generally very brisk in both the St. Louis and New York centers. Slight premiums have occasionally been obtained over the New York price of 8c., but most of the metal has been sold at the 8c. level, and is available today at that price. September shipment is still in demand, but the bulk of the sales made were for October delivery. One producer characterized the market as being one in which sales had to be pressed, and called attention to the inquiries coming into the market which originated in cities not generally considered important lead-consuming points. In St. Louis lead was sold for 7.825c. and 7.85c. all week. Today it is reported to be offered at 7.80c., but no sales have been recorded at that quotation. Producers are entering the month of October in a more comfortable position with respect to supplies than they had any reason to anticipate a few weeks ago. On the other hand, consumers are known to require lead for October shipment. The trend of the market is uncertain. Although quiet, the market is by no means a buyer's market—neither is it a producer's.

Recession in Zinc

Sales of Prime Western zinc have been fair, but at prices that decreased almost daily. The market was 6.15c. East St. Louis last Thursday, but declined to 6.10c. today. Galvanizers have been the chief purchasers. They are reported to be operating at 50 per cent of capacity, which is a pronounced improvement above the condition a few months ago, when they were working at 35 per cent of capacity, but part of the improvement is an effort to rush work on existing contracts to avoid cancellations. New business is poor in amount. The high-grade market remains at 8@8¼c. delivered.

Tin Market Erratic

Heavy speculation in tin on the London market caused the price of Straits tin in New York to drop from 47⅝c. per

lb. to 45⅝c. in three days. It also caused the market to advance to 47¼c. today. Sales to domestic consumers have been good since Monday. The sharp variations in the price of tin are unsettling confidence in the market. Two powerful financial groups are reported to be struggling for control of the market in London.

Arrivals of tin in long tons amounted to 3,855 tons through Sept. 20.

Exchanges Steady

Most foreign currencies have moved within narrow limits. On Tuesday francs were 5.265c., lire, 4.375c., and Canadian funds in New York at par.

Silver Still Higher

The New York silver market reached its highest level for the year on Sept. 23, the quotation being 69⅞c. The chief buyer is India, with occasional inquiry for Continental account.

Mexican Dollars—Sept. 18th, 53⅜c.; 19th, 53½c.; 20th, 53½c.; 22d, 53⅜c.; 23d, 53⅜c.; 24th, 53⅜c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, £125 per long ton.

Antimony—Per lb.:
Chinese brands, 11¼c.
W. C. C. brand, 13c.
Cookson's "C" grade, 13@13¼c.
Chinese needle, lump, nominal, 8½@9c.
White oxide, Chinese, 99 per cent Sb_2O_3, 12@13c.

Bismuth—$1.85@$1.90 per lb. London, 7s. 6d.

Cadmium—60c. per lb. London, 2s. 6d.

Cobalt—$2.50@$3 per lb. for spot.

Iridium—$260@$270 per oz.
Iridium alloyed with platinum, $280 @$286.

Nickel—27½@28½c. per lb. for 99 per cent virgin metal. London, £135 long ton.

Osmiridium—Crude, $58.50 per oz.

Osmium—$95@$104 per oz.

Palladium—$80 per oz. Crude, $60 per oz.

Platinum:
Refined, $118 per oz.
Crude, $112@$114.

Quicksilver—$72 per 75-lb. flask. San Francisco wires $71.50; London, £13¾.

Rhodium—$85@$90 per oz.

Ruthenium—$40@$45 per oz.

The prices of Germanium Oxide, Magnesium, Molybdenum, Monel Metal, Radium, Selenium, Tellurium, Thallium, Tungsten and Zirconium are unchanged from the prices given in the Sept. 6 issue.

Metallic Ores

Chrome—$19@$24, depending upon grade and source. Nominal.

Manganese—41@45c. per long ton unit, seaport, c.i.f. Nominal.

Molybdenum—70c. per lb. of MoS_2 for 85 per cent concentrates. Nominal.

Tungsten Ore—Per unit, N. Y.:
High-grade wolframite, $8.50@$8.75.
High-grade scheelite, $9.
Ordinary grades, $8.25@$8.50. Nominal.

Iron Ore, Magnetite, Tantalum, and Vanadium are unchanged from Sept. 6 quotations.

Zinc and Lead Ores Lower

Joplin, Mo., Sept. 20, 1924

Zinc Blende	Per Ton
High	$44.75
Premium, basis 60 per cent Zn	$43.00
Prime Western, 60 per cent Zn	$42.00
Fines and slimes	$41@$40.00
Average settling price, all	$42.31
Lead Ore	
High	$112.00
Basis 80 per cent lead	$107.50
Average settling price, all	$109.48

Shipments for the week: Blende, 13,945; lead, 1,971 tons. Value, all ores the week, $805,950.

Offerings on lead were lowered $2.50 per ton, and all grades of zinc were lowered $1 per ton. Purchases for the week were 12,590 tons, with a production of 15,000 tons. However, a large quantity of the increased production is in the hands of companies that can withhold it from market when the price is not acceptable. E. H. Wolff & Co. have been chosen local representatives of the Belgian interests that expect to engage in exporting ore from this district when satisfactory freight rates are established.

Platteville, Wis., Sept. 20, 1924

Zinc	Per Ton
Blende, basis 60 per cent zinc	$45.50
Lead	
Lead, basis 80 per cent lead	$112.00

Shipments for the week: Blende, 613 tons; lead, 40 tons. Shipments for the year: Blende, 22,331; lead, 760 tons. Shipments for the week to separating plants, 1,336 tons blende.

Non-Metallic Minerals

Asbestos:
Crude No. 1—$300@$325.
Crude No. 2—$150@$200.
Spinning fibers—$90@$125.
Magnesia and compressed sheet fibers —$50@$90.
Shingle stock—$45@$55.
Paper stock —$25@$40.
Cement stock—$15@$25.
Floats—$6@$12.
All per short ton, f.o.b. mines, Quebec, tax and bags included.

No. 1 Rhodesian crude, $280; No. 2, $175 per short ton, c.i.f. New York.

Fluorspar — F.o.b. Middle Western mines, per net ton:

Gravel, not less than 80 per cent CaF_2 and not over 5 per cent SiO_2, $17.50.

Gravel, not less than 85 per cent CaF_2 and not over 5 per cent SiO_2, $18.50.

Lump, not less than 85 per cent CaF_2, not over 5 per cent SiO_2 $18.50.

Ground, 93 to 98.5 per cent CaF_2 and not over 3 per cent SiO_2, $35 in bulk, $39 in bags or barrels.

Acid, ground, not less than 98½ per cent CaF_2 and not over 1 per cent SiO_2, $45 in bulk, $49 in packages.

Amblygonite, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli and **Zircon** are unchanged from Sept. 6 prices.

Mineral Products

Arsenious Oxide (white arsenic)—7½c. per lb.

Copper Sulphate—4.75c. per lb. for domestic in carload lots.

Potassium Sulphate, Sodium Sulphate, Sodium Nitrate and **Zinc Oxide** are unchanged from Sept. 6 prices.

Ferro-Alloys

Ferromanganese—$95 per gross ton.

Ferrotungsten — Domestic, 88@90c. per lb. contained tungsten.

Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferro-uranium and Ferrovanadium are unchanged from the prices given in the Sept. 6 issue.

Metal Products

Copper Sheets and Wire — Sheets, 20⅝c. base; wire, 15⅝c.

Lead Sheets, Nickel Silver, Yellow Metal and **Zinc Sheets** are unchanged from Sept. 6 prices.

Refractories

Chrome Brick—$45@$47 per net ton, f.o.b. Chester, Pa.

Firebrick — First quality, $40@$43 per M, Central Pa. works, Southern Ohio and Kentucky; second quality, $33@$37.

Magnesite Brick—$65@$68 per net ton, Chester, Pa.

Silica Brick—$35@$38 per M., Pa.; $48@$50, Birmingham.

Bauxite Brick, Magnesite Cement, and **Zirkite** are unchanged from Sept. 6 prices.

Iron Trade Dull

Pittsburgh, Sept. 23, 1924

Though the Steel Corporation began the abandonment of "Pittsburgh plus" almost immediately after the Federal Trade Commission's order of July 22 was issued, chiefly by quoting delivered prices and showing on invoices the freight actually paid, the trade at large took little interest in the matter until the Corporation's formal reply to the commission was made last week. There are now various rumors in circulation as to bases being established at Chicago and elsewhere. Formal action, however, is improbable, because the market is so irregular that even for Pittsburgh territory there is no well-defined base for some lines.

Mill operations reached a rate of nearly 60 per cent late in August. There has been no increase since and perhaps there has been a slight decrease. The increased keenness of competition indicates that mills are having difficulty in maintaining the higher operating rate.

Pig Iron—The market is dull, but with furnace quotations well maintained at $20 for bessemer, $19 for basic and $20 for foundry, f.o.b. Valley furnaces.

Connellsville Coke—Contracting for fourth-quarter furnace coke is now completed, except as idle furnaces may blow in later. Spot furnace coke is $3@$3.10 and spot foundry $4@$4.50.

Company Reports

Benguet Consolidated Mining Co.

Gold; Philippines

A semi-annual report of the Benguet Consolidated Mining Co. for the period ended June 30, 1924, states that 39,810 tons of ore, of an average value per ton of 32.00 pesos, was treated during the six months ended June 30, 1924. The gross value of gold and silver produced was 1,168,941.76 pesos. The new mill shows a higher extraction than the old mill, to the extent of about 2 per cent, the per cent for the last six months being 93.3.

A net profit for the six months of 493,634.61 pesos is shown. The ore reserve is as June 30, 1924:

	Tons	Value in Pesos
Positive—exposed on four sides	172,464	6,141,908.00
Probable—exposed on at least one side	125,873	4,060,118.00
Total	298,337	10,202,026.00

The following dividends have been paid since last report:

March 31	10 centavos per share—quarterly dividend
June 30	10 centavos per share—quarterly dividend

Balance Sheet as at June 30, 1924

Assets

	Pesos	Pesos
Fixed assets:		
Mines and mining properties	971,554.50	
Less—Reserve for ore depletion	971,554.50	
Property		960,574.41
Working assets		37,730.00
Development		150,000.00
Calvin Horr option		12,112.33
Inventories		330,077.56
Investments		60,048.62
Current assets:	Pesos	
Sundry debtors and debit balances	21,814.83	
Gold in transit	110,000.00	
Bank of the Philippine Islands—Fixed deposits	103,000.00	
Accrued interest	3,530.00	
Fire insurance—premium unexpired	2,525.44	
Bank balances	320,491.19	
Cash on hand	6,924.36	568,285.82
		2,118,828.74

Liabilities

			Pesos
Capital stock:			
2,000,000 shares at 0.70 pesos each—fully paid			1,400,000.00
Current liabilities			73,201.57
Reserve for depreciation of supplies			51,018.76
Profit-and-loss account			594,608.41
	Pesos		
Balance from Dec. 31, 1923	700,973.80		
Add profit for six months ended June 30, 1924	506,291.91	Pesos 1,207,265.71	
Less—Dividends paid	600,000.00		
Bonus to general manager	12,657.30	612,657.30	

Operating Account for the Year Ended June 30, 1924

	Pesos
To operation expenses	413,609.28
Taxes	31,843.65
General and marketing	88,486.10
Fire insurance	2,888.35
Profit on operation carried to profit and loss	632,114.38
	1,168,941.76
By bullion	1,168,941.76
	1,168,941.76

Profit-and-Loss Account

	Pesos
To depreciation	85,472.81
Development	54,682.35
Auto trucks operation	2,152.34
Net profit per balance sheet	506,291.91
	648,599.41
By balance from operation account	632,114.38
Exchange	1,922.81
Interest	9,098.73
Rentals	1,886.00
Store operation	3,577.49
	648,599.4

Kirkland Lake Gold Mining Co., Ltd.

A report of Kirkland Lake Gold Mining Co., Ltd., covering the period of operations from Jan. 1, 1923, to Dec. 31, 1923, states that a great deal of development work was done on the upper levels, the main shaft being down to a depth of 1,000 ft.

The mill treated 45,449 tons of ore, from which was recovered $223,102.40.

Balance Sheet, Dec. 31, 1923

Assets		
Cash	$545.46	
Bullion on hand	7,298.73	
Accounts receivable	935.65	
Inventories of supplies	16,946.25	
Unexpired insurance	1,630.14	
Unexpired workmen's compensation	452.19	
		$27,808.42
Mining claims		1,000,000.00
Buildings, plant and equipment		288,603.16
Development		357,424.84
		$1,673,836.42
Liabilities		
Wages accrued	$2,831.01	
Wages unclaimed	257.14	
Bills payable	382,400.00	
Interest accrued	141,469.78	
Current accounts	16,881.94	
	$543,839.87	
Capital stock—paid up	$2,000,000.00	
Depreciation	62,916.77	
	$2,062,916.77	$2,606,756.64
		$932,920.22
Discount on shares	$763,332.84	
Profit-and-loss account	169,587.38	
		$932,920.22

Financial Statement for the Six Months Ended June 30, 1924

Balance Sheet

Assets			
Cash in banks and on deposit	$43,602.82		
Inventories of supplies	15,890.78		
Accounts receivable	1,309.16		
Unexpired insurance	2,169.53		
			$62,972.29
Mining claims			1,000,000.00
Buildings, plant and equipment			288,704.92
Development			357,424.84
			$1,709,102.05
Liabilities			
Wages accrued	$2,613.15		
Wages unclaimed	257.14		
Current accounts	6,918.90		
		$9,789.19	
Capital stock—authorized			
Common shares	$4,000,000.00		
Preference shares	1,000,000.00		
	$5,000,000.00		
Less in treasury, unissued			
Common shares $1,833,331.00			
Preference shares 416,667.00			
	2,249,998.00	2,750,002.00	
Depreciation as at Dec. 31, 1923		62,916.77	
			2,822,707.96
			$1,113,605.91
Discount on shares issued		$909,165.06	
Profit-and-loss account		204,440.85	
			$1,113,605.91

Mining Accounts

Receipts		
Bullion sales	$46,512.73	
Rents	486.91	
Interest	83.64	
		$47,083.28
Charges		
Operation	$75,919.10	
Administration	6,017.65	
		81,936.75
Loss for the period		$34,853.47

Profit-and-Loss Account

Balanced forward from Dec. 31, 1923	$169,587.38
Transferred from mining account as of June 30, 1924	34,853.47
Debit balance	$204,440.85

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

There has been considerable firmness in fir, hemlock and spruce timbers in New England and the Far West, during the past month. Clay products are also stronger, particularly in the Middle West. Weakness, however, continues in black and blue steel sheets, railroad spikes and bolts, steel structurals, cast-iron pipe, nails, linseed oil and manila rope.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Blue Annealed No. 10	$2.65@2.70	$3.90	$3.80	$4.75	$3.89
Black No. 28	3.40@3.50	4.65	4.50	5.55	4.60
Galvanized No. 28	4.55@4.60	5.65	5.50	6.25	5.60

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2.80	$3.15	$3.65	$3.75	$4.35	$3.72
Track bolts	3.75	4.00@4.25	4.65	4.65	5.85	4.57
Standard section angle bars	2.75	2.75	3.40	3.35	4.00	3.20

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.90@2.00	$2.75	$3.34	$4.20	$3.25	$3.10	$3.00
Channel, 3 to 15 in.	1.90@2.00	2.75	3.34	4.20	3.25	3.10	3.00
Angles, 3 to 6 in., ¼ in. thick	1.90@2.00	2.75	3.34	4.20	3.25	3.10	3.00
Tees, 3 in. and larger	1.90@2.00	2.75	3.34	4.20	3.30	3.10	3.00
Plates	1.60@1.90	2.50	3.34	4.20	3.25	3.10	3.00

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12½%

	New York	Cleveland	Chicago
Drill Rod (from list)	60%	40@55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD—	⅛ to 3	62	50½	¼ to 1¼	30	13
LAP WELD—	2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	44%	53%	46%

CAST IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$56.60@57.60	$63.60	$50.00	$56.20	$51.60	$56.00

Nuts—	New York	Cleveland	Chicago
Hot pressed, sq., per 100 lb. Off list	$1.50	$4.00	$4.00
Cold punched, sq., per 100 lb. Off list	1.50	4.00	4.00

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1162	$0.1263	$0.089	$0.125	$0.077@.086	$0.108	
6x12x12	.1743	.1895	.114		.103@.114	.156	$0.2786*
8x12x12	.2179	.2369	.163	.215	.14 @.158	.244	.3448†

* 10x12x12; † 12x12x12.

MACHINE BOLTS—

	New York	Cleveland	Chicago
All sizes up to 1x30-in.	50%	60-10-5%	60%

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers at yards in San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$28.00	$29.00	$30.00	$35.00
3x6 and 8	28.00	29.00	30.00	35.00
4x4-6 and 8	28.00	29.00	30.00	35.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago 20 Ft. and Under	Chicago 22-24 Ft.
3x4 to 8x8	$40.00	$41.00	$52.00	$56.00
3x10 to 10x10	46.00	47.00	53.00	57.00
3x12 to 12x12	51.00	52.00	55.00	58.00

Other Cities	8 x 8-In. x 20 Ft. and Under Pine	Fir*	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir*
Boston	$56.00	$56.00†	$52.00	$50.00	$63.00	$65.00†
Cincinnati	40.00	74.00	74.00	88.00	44.00	78.00
Denver	.....	34.75	34.75	34.75	.....	34.75
Minneapolis	40.00	37.75	39.00	.....	43.10	37.75
Kansas City	38.25	.....	.....	.....	48.25	.....
Birmingham	20@30	.....	.....	.....	25@33	.....

* Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.80	$3.80	$4.10	$4.55	$3.24	$4.95
Cut	2.90	4.45	5.25	5.00	3.49	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
NewYork, del. by truck	$2.50@2.60	$2.50@2.60	$2.70@2.80
Chicago, f.o.b.	2.20	2.20	2.20
Cleveland, f.o.b.	2.39	2.39	2.46

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	280-lb. net Common
New York	$18.20	$13.10	$3.75	$3.00@$3.25
San Francisco	22.60	....	....	(180-lb. net) 2.15

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$1.03	$0.96	$1.05	$1.14

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry Current	Dry 1 Yr. Ago	In Oil Current	In Oil 1 Yr. Ago
Red	14.75	14.00	16.25	15.50
White	14.75	14.00	14.75	14.00

HOSE—Quotations at New York warehouses:

Fire Protection 50-Ft. Lengths
Underwriters' 2½-in. coupled, single jacket ..... 56c per ft.

Air—Best Grade
½-in., per ft. 3 ply $0.36 4 ply $0.44½

Steam—Discounts from List
First grade 30–5% Second grade 40–5% Third grade 50%

RUBBER BELTING—The following discounts from list apply to rubber transmission belting:
Best grade 50% Second grade 50–10%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

Grade	Discount from list
Medium	40–2½%
Heavy	30–5%

RAWHIDE LACING—For cut, best grade, 45–5%, 2nd grade, 55%. For laces in sides, best, 41c. per sq.ft.; 2nd, 37c. Semi-tanned: cut, 45–5%; sides, 41c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ½ in.	$0.90
Rubber sheet	.45
Rubber sheet, wire insertion	.70

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils.

Atlanta	$0.19	New Orleans	$0.17½
New York	.18½	Seattle	.17
Chicago	.18	San Francisco	.17

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
New Orleans	.235	.29
San Francisco	.1625	.1925

FLOTATION OILS—All prices are per gal. in carload lots; 50-gal. bbls., gross weight 500 lbs.

Pine oil, steam dist., f.o.b. New York	$0.60
Pine tar oil, f.o.b. New York	.30

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. Palmerton, Pa., per lb.	$0.08½
Litharge, f.o.b. New York, kegs, per 100 lb.	14.75
Sodium cyanide, 220 lb. single case lots, f.o.b. New York, per lb.	.19@.22

Mining Stocks

Week Ended September 20, 1924

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb	...	...	*37	...	...
Anaconda	New York	39	37⅛	37⅛	De.15, Ja.21, Q	0.75
Arcadian Consol.	Boston	1⅛	1⅛	1⅛	...	...
Ariz. Com'l.	Boston	11	10⅝	10⅝	Jy.19, Jy.31	0.50
Calaveras	N. Y. Curb	...	...	2	...	...
Calumet & Arizona	Boston	52	51	51⅛	Se. 5, Se. 22 Q	0.50
Cal. & Hecla (New)	Boston	16⅛	15⅛	15⅛	My. 31, Jn. 16	0.50
Canario Copper	N. Y. Curb	4	3⅛	4	...	...
Cerro de Pasco	New York	47	45⅛	46⅛	Jy. 17, Au. 1	1.00
Chile Copper	New York	33⅛	33	33⅛	Se.3, Se.29, Q	0.62½
Chino	New York	20⅛	19⅞	20	Sept., 1920,	0.37½
Con. Coppermines	N. Y. Curb	3⅛	3⅛	3⅛	...	...
Copper Range	Boston	26⅛	24⅛	24⅛	May, 1923	1.00
Crystal Copper	Boston Curb	*60	*56	*58	...	...
Davis-Daly	Boston	*45	*45	*45	Mar., 1920	0.25
East Butte	Boston	4⅛	4⅛	4⅛	Dec., 1919	0.50
First National	Boston Curb	...	...	*38	Feb., 1919,	0.15
Franklin	Boston	...	...	*50	...	...
Gadsden Copper	Boston Curb	*64	*60	*60	...	...
Granby Consol.	New York	18⅛	17⅛	18⅛	May, 1919	1.25
Greene-Cananea	New York	15⅞	15⅛	15⅞	Nov., 1920	0.50
Hancock	Boston	...	...	1⅛	...	...
Howe Sound	N. Y. Curb	2⅛	2⅛	2⅛	Ap.1, Ap.15, Q	0.05
Inspiration Consol.	New York	27⅛	26⅛	26⅛	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	...	...	3	May, 1923	0.15
Isle Royale	Boston	16	15⅛	16	Se. 1, Se. 15,	0.50
Jerome Verde Dev.	N. Y. Curb	1⅛	1	1	...	...
Jib Consol	N. Y. Curb	*80	*58	*60	...	...
Kennecott	New York	48⅛	46⅝	48	Se.5, Oc.1, Q	0.75
Keweenaw	Boston	*65	*65	*65	...	...
Lake Copper	Boston	2	2	2	...	...
Magma Copper	New York	36⅛	35⅛	35⅝	Jan., 1919	0.50
Mason Valley	N. Y. Curb	1⅝	1⅝	1⅝	...	...
Mass Consolidated	Boston	...	...	1	Nov., 1917	1.00
Miami Copper	New York	22⅛	22	22⅛	Au.1, Au.15, Q	0.15
Mohawk	Boston	34⅛	32⅛	34	Se. 22, Oc. 13,	1.00
Mother Lode Coa.	New York	8⅛	8	8	Jn.13, Jn.30	0.37½
Nevada Consol.	New York	14⅛	14	14	Sept., 1920,	0.25
New Cornelia	Boston	21⅛	21	21	Au.8, Au.25,	0.25
New Dominion	N. Y. Curb	...	...	2⅛	...	...
North Butte	Boston	4⅛	4⅛	4⅛	Oct., 1918,	0.25
Ohio Copper	N. Y. Curb	1⅛	1 7/16	1 7/16	...	...
Old Dominion	Boston	22⅛	20⅛	22	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†115	†110	...	Se.20, Oc.1 Q	1.00
Quincy	Boston	21⅓	20⅛	21	Mar., 1920	1.00
Ray Consolidated	New York	12⅛	12	12⅛	Dec., 1920	0.25
Ray Hercules	N. Y. Curb	*20	*20	*20	...	...
St. Mary's Min. Ld.	Boston	37⅛	36	36	Ap.22, My.20	3.00
Seneca Copper	New York	1⅛	1⅛	1⅛	...	...
Shannon	Boston	1⅛	1 1/16	1 1/16	Nov., 1917	0.25
Shattuck Arizona	New York	6⅛	6⅛	6⅛	Jan., 1920	0.25
Superior & Boston	Boston	1⅛	1⅛	1⅛	...	...
Tenn. C. & C. cfs.	New York	8⅛	8	8	De.31, Ja.15, Q	0.25
United Verde Ex.	N. Y. Curb	26	26	26	Oc.3, No.1	0.50
Utah Copper	New York	78⅛	76	77⅝	Se.15, Se.30, Q	1.00
Utah Metal & T.	Boston	*32	*25	*25	Dec., 1917	0.30
Victoria	Boston	*50	*50	50	...	...
Walker Mining	N. Y. Curb	3	3	3	...	...
Winona	Boston	...	...	*30	...	...
NICKEL-COPPER						
Internat. Nickel	New York	18⅜	17⅛	18⅛	Jy.17, Au.1, Q	1.50
Internat. Nickel pfd.	New York	88	88	88	Jy.17, Au.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	4	3⅜	...	...	...
National Lead	New York	157⅛	149⅛	156⅛	Se.12, Se.30, Q	2.00
National Lead pfd.	New York	...	...	118	Au. 22, Se. 15, Q	1.75
St. Joseph Lead	New York	29	28⅛	29	Se. 9, Se.20	0.50
ZINC						
Am. Z. L. & S.	New York	8⅛	8	8	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	28	27⅛	27⅛	Nov., 1920	1.50
Butte C. & Z.	New York	5⅛	5	5	Ma., 1923	0.50
Butte & Superior	New York	17⅛	16⅛	16⅛	Je.15, Je. 30, Q	0.50
Callahan Zn-Ld.	New York	3⅞	3⅛	3⅛	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	160	160	160	Aug. 9, 1924	2.00
United Zinc	N. Y. Curb	...	...	*25	...	...
Yellow Pine	Los Angeles	56	56	56	June, 1924	0.04
SILVER						
Alvarado	N. Y. Curb	...	...	*90	...	...
Beaver Consol.	Toronto	*16	*15⅞	*15⅞	May, 1920	0.03
Castle-Trethewey	Toronto	*73	*72	*72⅞	...	...
Coniagas	Toronto	1.60	1.55	1.55	Ap.20, My.1	0 02½
Crown Reserve	Toronto	*49	*43⅞	*48	Jan., 1917	0.05
Keeley	Toronto	2.27	2.25	2.26	Sept. 15, SA	0.12
Kerr Lake	N. Y. Curb	1⅞	1⅝	1⅞	Oc. 1, Oc. 15,	0.12½
La Rose	Toronto	*8	*8	*8	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.50	1.42	1.47	...	...
McKinley-Dar.-Sav.	Toronto	*12	*10	*11½	Oct., 1920	0.03
Mining Corp. Can.	Toronto	2.70	2.68	2.69	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6¼	6⅛	6⅛	Jn.30, Jy.21, Q	0.15
Ontario Silver	New York	...	...	6⅛	Jan., 1919	0.50
Temiskaming	Toronto	*20	*20	*20	Jan., 1920	0.40
GOLD						
Alaska Gold	New York	*12½	*12⅛	*12⅛	...	...
Alaska Juneau	New York	1⅛	1⅛	1⅛	...	...
Argonaut	Toronto	*34	*31	*32	...	...
Carson Hill	Boston	1⅛	1⅛	1⅛	...	...
Cresson Consol. G.	N. Y. Curb	3⅛	3⅛	3⅛	Jn.30, Jy.10, Q	0.10
Dome Mines	New York	15⅛	15⅛	15⅛	Jn.26, Jy.21, Q	0.50
Golden Cycle	Colo. Springs	1.27	1.27	1.27	My.31, Jn.10 Q	0.03
Hollinger Consol.	Toronto	14.55	14.10	14.50	Se.18, Oc.6, M	0.05
Homestake Mining	New York	45	44	45	Se.20, Se.25, M	0.50
Kirkland Lake	Toronto	*20	*19	*19½	...	...
Lake Shore	Toronto	3.86	3.83	3.85	Se.1, Se.15, Q	0.05
McIntyre-Porcupine	New York	16⅛	16⅛	16⅛	Au. 1, Se. 1,	0.25
Newray	Toronto	*24	*23	*23	...	...
Portland	Colo. Springs	48	48	48	Oct., 1920	0.01
Teck-Hughes	Toronto	1.29	1.27	1.28	...	...
Tom Reed	Los Angeles	18⅛	18⅛	18⅛	Dec., 1919	0.02
Tough-Oakes	Toronto	*63	*61	*62⅛	...	...
United Eastern	N. Y. Curb	...	...	*43	Jy.18, Jy.31, Q	0.05
Vipond Cons.	Toronto	1.29	1.20	1.27	...	...
Wright-Hargreaves	Toronto	3.75	3.68	3.70	Se.15, Oc. 1, Q	0.02½
GOLD AND SILVER						
Black Oak	N. Y. Curb	...	...	*89	...	...
Con. Cortez	N. Y. Curb	...	...	*15	...	...
Con. Virginia	San Francisco	8⅛	7⅛	7⅛	...	...
Continental Mines	N. Y. Curb	2⅛	2⅛	2⅛	...	...
Dolores Esperanza	N. Y. Curb	...	...	*50	Jy. 1, Jy. 10 Q	0.05
Premier Gold	N. Y. Curb	2⅛	2⅛	2⅛	Se.25, Oc 30	0.08
Tonopah Belmont	N. Y. Curb	*60	*60	*60	Apr., 1923	0.05
Tonopah Divide	N. Y. Curb	*27	*26	*26	Se.22 Oc. 10	0.10
Tonopah Extension	N. Y. Curb	3⅛	3⅛	3⅛	Se 10, Oc.1	0.05
Tonopah Mining	N. Y. Curb	2⅛	2	2	Ap. 6, Ap. 21	0.07½
Unity Gold	N. Y. Curb	1⅝	1⅝	1⅝	...	...
West End Consol.	N. Y. Curb	*75	*71	*71	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	...	...	*50	June, 1918	0.02
SILVER-LEAD						
Ahumada	Boston Curb	6⅜	6⅛	6⅜	Se.16, Oc. 2, X	0.15
Bingham Mines	Boston	†17	†15⅛	...	Sept., 1919	0.25
Cardiff M. & M.	Salt Lake	...	...	*80	Dec., 1920	0.15
Chief Consol.	Boston Curb	2⅛	2⅛	2⅛	Ap 19, My.1, Q	0.10
Columbus Rexall	Salt Lake	21	16	21	Aug., 19.0	0.03
Consol. M. & S.	Montreal	46⅛	45	45⅞	Jn 30, Jy.15	0.75
Daly Mining	Salt Lake	...	...	2.00	July, 1920	0.10
Erupcion	Boston Curb	2⅜	2⅛	2⅛	Se. 15, Oc.2, X	0.15
Federal M. & S.	New York	...	...	12⅛	Jan., 1909	1.50
Federal M. & S. pfd.	New York	51⅛	50⅛	50⅛	Au.25, Se.15, Q	1.75
Florence Silver	Spokane	7⅛	7⅛	7⅛	Apr., 1919, QX	0.01
Hecla Mining	N. Y. Curb	9	9	9	Sept. 15, 1924	0.25
Iron Blossom Con.	N. Y. Curb	...	...	*21	Oct., 1923	0.02
Marsh Mines	N. Y. Curb	...	...	*5	June, 1921	0.02½
Park City	Salt Lake	4.45	4.45	4.45	Se.15, Oc.1,	0.15
Park Utah	N. Y. Curb	...	...	3⅛	Mc.15, Ap.1	0.15
Prince Consol.	Salt Lake	*8	*7⅛	*7⅛	Nov., 1917	0.02
Silver King	N. Y. Curb	...	...	*50	Se.20, Oc.1,	0.15
Silversmith	Spokane	*32	*30	*30⅛	Jy.1, Jy. 10,	0.01
Tamarack-Custer	Spokane	1.44	1.37	1.44	Se 22, Se 29,	0.25
Tintic Standard	Salt Lake	6.50	6.30	6.50	Jy.28, '24, X	0.25
Utah-Apex	Boston	2⅛	2⅛	2⅛	Se.5, Se.15, Q	0.25
IRON						
Bethlehem Steel	New York	45⅜	43⅞	45⅛	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit	...	...	*40	...	...
Char. Iron pfd.	Detroit	*91	*91	*91	...	...
Colorado Fuel & Iron	New York	45⅜	39⅛	44	Au.11, Au. 25 Q	2.00
Col. Fuel & Iron pfd.	New York	...	...	108⅛	Feb., 1923	2.00
Gt. North'n Iron Ore	New York	29⅛	28⅛	29⅛	De.10, De.27	2.00
Inland Steel	N. Y. Curb	...	...	46	Au.15, Se.1 Q	0.62½
Mesabi Iron	N. Y. Curb	...	...	2⅛	...	...
Replogle Steel	New York	12	10⅛	11⅞	...	...
Republic I. & S.	New York	49	46⅛	47⅛	May, 1921	1.50
Republic I. & S. pfd.	New York	...	...	89	Se 15, Oc.1, Q	1.75
Sloss-Sheffield S.&I.	New York	74⅛	71	73⅛	Se.11, Se.20, Q	1.50
Sloss-Shef. S.&I.pfd.	New York	91⅛	91⅛	91⅛	Se.20, Oc.1, Q	1.75
U. S. Steel	New York	109⅛	106⅛	108⅛	Se.1, Se.29 QX	1.75
U. S. Steel pfd.	New York	122⅛	121⅛	122⅛	Au. 5, Au. 30 Q	1.75
Virginia I. C. & C.	New York	37⅞	37⅛	37⅛	De.15, Ja. 2	1.50
Virginia I.C.&C.pfd.	New York	...	...	71	Jn.17, Jy.1	2.50
VANADIUM						
Vanadium Corp.	New York	27⅛	25⅛	25⅛	Jan., 1921	1.00
ARSENIC						
Western Utah Copper	N. Y. Curb	...	...	*17	...	...
ASBESTOS						
Asbestos Corp.	Montreal	27	27	27	Se.29, Oc.15 Q	1.00
Asbestos Corp. pfd.	Montreal	70	68⅛	70	Oc.1, Oc.15, Q	1.50
SULPHUR						
Freeport Texas	New York	8⅛	7⅞	8⅛	Nov., 1919,	1.00
Texas Gulf	New York	79⅛	76	78⅝	Se.2, Se. 15, QX	1.75
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	4⅜	3⅛	4⅛	...	...
MINING, SMELTING AND REFINING						
Amer. Metal	New York	48⅛	46	48	Au. 18, Se. 2 Q	0.75
Amer. Metal pfd.	New York	112	112	112	Au.20, Se. 2, Q	1.75
Amer. Sm. & Ref.	New York	75⅛	73	75	Jy.11, Au. 1, Q	1.25
Amer.Sm.&Ref.pfd.	New York	103⅛	102⅛	103	Jy.11, Au. 1.	1.25
U. S. Sm. R. & M.	New York	34⅛	32⅝	33⅝	Jan., 1921,	0.50
U.S. Sm. R.&M.pfd.	New York	44	43⅝	44	Jy.7, Jy.15 Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial, X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur R. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Colorado Springs, Colorado Springs Stock Exchange.